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LIST OF FOREIGN AGENTS (see first page "Official Notices").

Contents:

	PAGE
The Wireless Exhibition	441
Fabians and Farming	442
Japanese Electrical Industry	442
Trade Opportunities in Egypt	442
High-voltage Cables, by E. A. Beavis (*illus.*)	443
The Measurement of Electrical Service, by E. Graham (*illus.*)	446
The Wireless Exhibition, 1925 (*illus.*)	449
The Municipal Tramways Association—I	451
Steel-Concrete Transmission Poles (*illus.*)	453
Business Notes	455
Electricity Supply in Nottingham and District (*illus.*)	459
Lighting and Power Notes	463
Tramway and Railway Notes	464
Telegraph and Telephone Notes	464
Radio Notes	464
Contracts Open and Closed	465
Forthcoming Events	466
Notes	466
Institution Notes	467
Our Personal Column	468
New Companies Registered	468
Official Returns of Electrical Companies	468
City Notes	468
Stocks and Shares	469
Market Quotations for Chemicals and Metals	470
The British Association—IV	471
Electricity Supply and Electrical Plant at the Southampton Docks, by H. Wauchope (*illus.*)	471
Standardisation in Industry, by C. le Maistre	473
Recent Progress in the Peat Problem, by Dr. R. Mollwo Perkin	473
Egyptian Trade and Finance	474
Underground Cables in the United States (*illus.*)	475
High-frequency Induction Furnaces, by Donald F. Campbell (*illus.*)	476
Electricity in Agriculture, by R. Borlase Matthews	477
Proposed New Australian Tariffs	478
New Electrical Devices, Fittings, and Plant (*illus.*)	479
Correspondence—	
The Manufacture of Induction Motors	479
The "Davidson" Dust Collector	479
Charges for Electricity Supply	479
Choosing and Using an Electric Washer	480
Super-pressure Electric Cables	480
Published Specifications	480
Contractors' Column	Advertisement page xxxvi

The Wireless Exhibition.

THE exhibition of wireless apparatus—mainly for use in connection with the broadcasting service—which is in progress at the Albert Hall affords an opportunity to take stock of our position with regard to this application of electricity to the use and convenience of mankind. Considering that broadcasting was unheard of until 1920, and was only practised on a very limited and purely experimental scale during the first year or so, the development which has taken place since a national service was undertaken by the British Broadcasting Company in 1922 is nothing less than astounding. The United States, taking its cue from the achievements of the Marconi engineers and private experimenters in this country, plunged into an orgy of unrestricted broadcasting from which it does not appear to have yet recovered; we, fortunately, were more cautious, and established a controlled monopoly of broadcasting which has proved highly beneficial, both to the public and to the trades concerned: to the former, by ensuring the sane and efficient use of the ether, without interference between conflicting programmes, and to the latter by providing them with an assured market for their products and enabling them to manufacture apparatus to comply with clearly defined conditions.

The success of the policy adopted was well illustrated at the luncheon given to Senatore Marconi last week by the N.A.R.M.A.T., when the speakers bore witness to the fact that British broadcasting and British apparatus were the best in the world, and were in great demand beyond our borders. That the number of licence-holders is already close upon 1½ millions is in itself convincing testimony to the merits of the system, and an amazing record for a period of less than three years; and to that number must be added, we believe, quite a large number of unlicensed listeners who have not thought it incumbent upon them to bear their share of the cost of the programmes which they enjoy.

The early days of the automobile were marked by the numbers of untutored amateur mechanics who plunged into the mysteries of the internal-combustion engine with a zest unquenchable by oil and grime, but there is no precedent for the extraordinary enthusiasm with

which the wireless field has been invaded by hundreds of thousands who previously could not have adjusted an electric bell, but who essayed to capture Hertzian waves with an ardour that was rewarded by an incredible measure of success, aided by a specialist Press that now comprises no fewer than 18 periodicals and innumerable popular handbooks. The exhibition is a rallying-point for this army of would-be electricians, but it is also well worth visiting by the minority who are professionally interested in electrical engineering; whilst they will find there few striking innovations, they will be enabled to gauge the progress that has been made in the perfecting of detail and the evolution of improvements in design, and to appreciate the fact that the exhibits, taken all round, bear testimony to the very high standards of quality that are maintained by the manufacturers. Out of a chaos of complicated connections a few comparatively simple circuits are becoming more or less standard practice, and whilst it is possible to ring the changes indefinitely (perhaps that is the secret of the wireless craze) there is no need to stray far from the paths of simplicity and economy in order to secure perfectly satisfactory results.

Nevertheless, it must be admitted that so long as the overall efficiency of the receiving apparatus is far below one per cent. there is immense scope for invention. The telephone is essentially unchanged from its earliest form. If it made use of even five per cent. of the energy put into it, every headphone would become a "loud speaker." Here is a splendid opening for the experimenter!

Fabians and Farming.

UNDER the chairmanship of Captain Basil Hall, R.N., the fourth and last week of the Fabian Summer School was devoted to the consideration of rural problems. It was quite appropriate to this subject that the school was housed this year at the Bradley Agricultural College, Mitcheldean, Glos.

It is a sign of the times that an evening was allotted to the uses of electricity in agriculture, when Mr. R. Borlase Matthews read a paper on the subject, and a very animated and interesting discussion followed, in which the principal points raised were a demand for more technical information concerning certain of the farming applications; the cost of power; the comparison of hydro-electric and steam-generated power; electric ploughing; making hay without sunshine; the matter of distribution; and overhead lines *versus* cables. Naturally also, as might be expected of such an Association, the subject of economics and the question whether labour would be dispensed with or increased on farms were discussed. The opinion of the author of the paper was that the output per acre and per man would be increased and employment improved generally in rural districts, for the experience of other countries was that much work at present carried out in the towns was transferred to the country when electric power was available there.

A summary of the principal points of the paper will be found elsewhere in this issue.

Japanese Electrical Industry.

THE depressed condition of affairs in Japan has, not unnaturally, led to an agitation for the support of Home industries. It is reported that, consequent upon the great decrease in its revenue and in order to relieve the dullness of trade, the Imperial Government Railways Department has resolved to purchase all requisites from Japanese manufacturers, excepting small products which cannot be made in the country. Further, Japanese industrial concerns are stated to have a predilection for foreign electrical machinery and apparatus, and those interested in the future well-being of Japanese electrical engineering industry are very much exercised by this tendency. The Electrical Association is understood to have decided to make extensive and thorough investigations regarding the weak and defective points in Japanese products, through a committee that has been set up. This committee consists of representatives of 36 electrical machinery manufacturers, including several well-known companies, also of the Tokyo Municipal Electrical Bureau, while the Departments of Communications, Railways, and of the Army and Navy are to be asked to co-operate in the inquiry.

The subject was recently touched upon in an article in the *Electrician's Friend*, written by Mr. S. Mayebara, the chief of the Engineering Section of the Electric Bureau of the Communications Department. Though he was able to give figures showing that the Japanese electric power supply industry was making steady progress, and that a large amount of new generating plant was in course of erection, he had to deplore the Japanese inclination to indiscriminately favour foreign production, especially at a time when it was claimed that Japan produced hydro and steam plant "not so inferior to the foreign products" as a correspondent expresses it in a communication to ourselves. Mr. Mayebara is reported to have urged Japanese engineers to use as much Japanese product as possible, even at the sacrifice of convenience, in order to develop the Japanese electrical machinery and apparatus industry.

With regard to new work in contemplation, we understand that the Imperial Government Railways Department has decided to commence upon the construction of the Shinano-gawa hydro-electric power station in the fiscal year 1926-27. The Osaka municipality has large extensions to its electric power system in prospect. Mr. Amenomiya, the chief of its Electricity Department, has been indicating vast expansion ideas for the next seven or eight years both in respect of power supply and in electric transportation. The 10,000-kW generators for the Kujo power station, which is part of the scheme, were recently obtained in England. Further additions of 20,000 to 30,000 kW per year are contemplated for some years to come, subject to the approval of the loan scheme by the Department of Finance.

Trade Opportunities in Egypt.

THE report of Mr. E. Homan Mulock, Commercial Secretary at Cairo, which we review in this issue, indicates that Egypt is in a position shared by few countries at the present time. The cotton industry is prosperous, and this has had a beneficial effect upon the general economic position of the country. In many quarters attention is being directed to the advantages of electricity, resulting in the placing of a fair quantity of orders for machinery and plant. Unfortunately, the bulk of this business went to our Continental competitors, Germany having been very successful. The reason is plain: the British quotations were 50 per cent. above the German tenders. Mr. Mulock says: "It is to be regretted that, with one exception only, United Kingdom manufacturers do not appear to have submitted tenders for provincial electrical undertakings." In view of the wide price margin, this is not to be wondered at. Nevertheless, in spite of what the report says, Great Britain supplied the second largest share of the imports of electrical machinery during 1924, although France led by a substantial amount, and this share was an improvement upon the previous year's value.

Referring to the supply of smaller appliances and materials, the report states that if British manufacturers had extended their advertising and trade propaganda they would have obtained a larger share of the business. We think that greater efforts are worth while in this market which shows every sign of continued expansion. Hitherto the political uncertainty has handicapped foreign enterprise, but there is reason to believe that stability is now in sight and the position should be easier.

It is worth noting that, *mirabile dictu*, nothing is said about long-term credits, which are proving a difficulty in so many markets just now.

High-Voltage Cables.

Dielectric Loss and Temperature Rise under Working Conditions.

By E. A. BEAVIS, B.Sc.(Eng.), A.M.I.E.E., A.C.G.I.

Introduction.

THE economical need for transmission of electrical energy at increasingly higher voltages has in recent years created many problems in connection with the design and manufacture of super-tension cables.

The question of dielectric losses has received universal attention: experience with the earlier paper-impregnated h.v. cables testified to its importance; in fact, the dielectric heating seemed likely to prove a serious limitation from the practical point of view.

A great deal of experimental investigation and research work has already been accomplished in this respect, and although the results available so far appear to be somewhat conflicting, much improvement is evidenced by the lower losses that characterise the more modern h.v. cables. With dielectric loss a matter of secondary consideration, it would seem that the present data in respect of current ratings available for voltages up to 11,000 V can be made applicable for much higher voltages with little or no modification.

In view, however, of our lack of definite knowledge or explanation of many of the dielectric phenomena occurring with high voltages, any conclusions drawn from isolated experiments on cable samples or impregnating compounds must necessarily be of somewhat tentative nature, and in practice allowance should be made for an appreciable factor of safety on the score of reliability.

Characteristics of Impregnated Paper Dielectric.

The losses occasioned with alternating current appear to be due mainly to the combined effects of hysteresis and current leakage,* the former varying with frequency, the latter independent and of electrolytic nature. The magnitude of each component varies rapidly with the temperature, hysteresis decreasing and current leakage increasing with rising temperature, so that the loss-temperature curve has a minimum point which usually coincides with the melting temperature of the impregnating material (between 90 deg. and 100 deg. F.).

At the lower temperatures where hysteresis loss entirely predominates, the effects produced are somewhat inconsistent; appreciable variations with voltage sometimes occur, and in many cases results are modified by past treatment which the particular cable may have undergone. Such changes generally decrease with rising temperature; beyond the minimum point results show more stability and the loss tends to become independent of frequency. The hysteresis effect gradually fades away as the impregnating compound gets more fluid, and at some temperature where current leakage alone prevails, the losses for a.c. and d.c. of equivalent voltage will correspond.

Fig. 2 represents some characteristic temperature curves for impregnated paper dielectric. The direct-current resistivity varies exponentially in a fairly regular manner; the value at any temperature τ can be approximately expressed by the equation—

$\rho_\tau = \rho_0/a^{\tau-60}$; ρ_0 is the resistivity at 60° F. and a the coefficient per degree F. (about 1.05 to 1.06).

For comparative purposes the quantity s/κ is the most important with regard to the conditions under a.c., and determines the power factor (usually signified as $s/p\kappa$ where $p=2\pi f$), and the loss at the temperature, frequency, and voltage concerned.

The general relation between a.c. resistivity and temperature is not capable of simple expression, the slope of the curve changing gradually on either side of the maximum, and finally merging at the higher temperatures into the equivalent d.c. curve. For a given voltage and frequency, however, between definite limits, the a.c. resistivity can be approximately represented by an equation of similar form to that for d.c.

In practice we are concerned chiefly with the conditions at maximum load when the loss is most important. For moderate voltages the permissible maximum conductor temperature is usually specified as 150 deg. F.; the temperature range in the dielectric will normally lie, therefore, between 100 deg. and 150 deg. F. Between these limits the a.c. resistivity can be expressed by the relation—

$\rho_\tau' = \rho_x' \beta^{\tau-x}$; ρ_x' represents the value at minimum loss temperature x°F. and β the coefficient per degree F. (about 1.02 to 1.03).

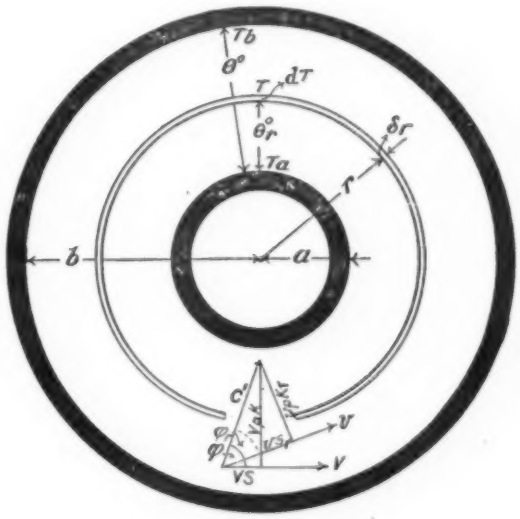


Fig. 1.—H.V. Single-Core Cable.

Resistivity and Temperature Gradient.

(*a*) *With Direct Current.*—Under working conditions a temperature gradient exists in the cable dielectric, and from the core (τ_a°) to the sheath (τ_b°) there is an appreciable drop in temperature (θ° F.). Now, if H is the heat passing through unit length of cable—neglecting losses and end effects—and k is the thermal resistivity of the material (in the required units)—

$$\theta = \tau_a - \tau_b = (\text{H}k/2\pi) \log_e b/a.$$

If τ be the temperature at any radius r, then

$$\theta_r = \tau_a - \tau = (\text{H}k/2\pi) \log_e r/a.$$

For an elemental concentric ring of unit length, thickness δr, and radius r (fig. 1), the dielectric resistance is given by—

$\delta \text{R} = \rho r\, \delta r/2\pi r = (\rho_a\, \delta r/2\pi r)\, a^{\theta r}$; ρ_a is the resistivity at τ_a.

Hence $\text{R} = (\rho_a/2\pi) \log_e b/a \times (a^\theta - 1)/\theta \log_e a =$
$(\rho_m/2\pi) \log_e b/a$ ... (1)

ρ_m is the true mean resistivity and equals $\rho_a \cdot f$ where f is a temperature factor, $(a^\theta - 1)/\theta \log_e a$, and if R_a is the resistance at uniform temperature τ_a, then

$$\text{R}_a = (\rho_a/2\pi) \log_e b/a\ ;\ \text{and } \text{R} = \text{R}_a \cdot f.$$

(*b*) *With Alternating Current.*—In the same way for the a.c. resistance, between the prescribed limits—

$$\text{R}' = (\rho' a/2\pi) \log_e b/a \times (\beta^\theta - 1)/\theta \log_e \beta = \text{R}_a' \cdot f'.$$

* Höchstädter. *E.T.Z.*, April 27th, 1922.

In practice, the power-factor equation is better adapted for calculation purposes, *i.e.*—

$$S/pK = 1/pKR' = (S/pK)_a \times 1/f' ; \ (S/pK)_a \text{ is the power factor at } T_a \quad \ldots \quad (2)$$

In order to gain some idea of the magnitude of this factor, let us consider a fairly general case in which the rise in temperature of the lead sheathing at maximum load is 50 per cent. of the total rise; then presuming T_a is 150 deg. F., with a ground temperature of 60 deg. F., T_b will be 105 deg. F. In this case $f=4.9$ (for $a=1.06$), and $f'=2.1$ (for $\beta=1.03$).

Potential and Temperature Gradient.

*With Direct Pressures.**—When a steady leakage current c is flowing through the dielectric, then by Ohm's law—

$$dV = -\rho r(dr\ 2\pi r)c, \text{ i.e. } -dV/dr = V/(r \log_e b/a) \times \rho r/\rho m = P_r\ a^{\theta r}/f \quad (P_r \text{ is the potential gradient with uniform temperature}) \quad \ldots \quad (3)$$

The potential gradient is modified by a temperature factor $a^{\theta r} \log_e a^{\theta} / (a^{\theta} - 1)$, and it will be seen that if there is much of a temperature range in the dielectric, the stress on the outer wall will be much greater than with uniform temperature; in fact, the maximum stress may revert to the layers next the sheath.

If we assume that $V/(a \log_e b/a)$ represents the maximum stress that the dielectric may be permitted to withstand for continuous working, then in order that this value shall not be exceeded under load conditions, the factor $a^{\theta r}/f$ must not be greater than r/a. In general with h.v. cables, the most economical ratio $b/a=e$, and in this case the maximum value a^{θ}/f must not exceed e. If the factor $a^{\theta r}/r$ is a constant, the cable will have an equal potential gradient throughout;

$$i.e.\ a^{\theta r}/r = 1/a, \text{ and } a^{\theta} = b/a,$$
$$\theta = (\log_e b/a) / \log_e a = 1 / \log_e a.$$

With $a=1.06$, the following values for θ are obtained:—

(*a*) Maximum potential gradient not to be exceeded, then θ must not be greater than 43 deg. F.

(*b*) For equal gradient throughout, $\theta=17$ deg. F. Under normal conditions these figures give about 150 deg. F. as the maximum conductor temperature, and 100 deg. F. for constant gradient. In the case of direct-current cables it would therefore seem that the potential gradient factor is a most important consideration with regard to the permissible temperature rise of the conductor.

With Alternating Pressures.—In this case the voltage across any part of the dielectric is dependent upon the power factor, and if c' is the current flowing, then—

$c' = V\sqrt{(p^2K^2+S^2)} = VpK\sqrt{(1 + \tan^2\theta)}$; where $\tan\theta = (S/pK)_m$, the true mean power factor.

The potential gradient can be obtained at once from the d.c. equation (3) by substituting the equivalent impedance in lieu of resistivity—

$$-\frac{dV}{dr} = \frac{V}{r \log_e b/a} \cdot \frac{i_r}{i_m} = \frac{V}{r \log_e b/a} \cdot \sqrt{\frac{(1/\rho m)^2 + (p K_m)^2}{(1/\rho r)^2 + (p K_r)^2}}$$

$$\text{Hence: } -\frac{dV}{dr} = \frac{V}{r \log_e b/a} \cdot \frac{\lambda m}{\lambda r} \cdot \frac{\sqrt{(S/pK)_m^2 + 1}}{(S/pK)_r^2 + 1} \cong$$

$$P_r \cdot \frac{\lambda m}{\lambda r} \cdot \frac{(2 + \tan^2\theta)}{(2 + \tan^2\theta_r)}. \quad (4)$$

The change in the dielectric coefficient is almost negligible, and it is observed that the temperature gradient has little effect on the potential gradient with alternating current.

Dielectric Loss and Current Rating.

The effect of the dielectric losses upon the temperature gradient has not so far been considered; as, however, the transmission voltage is increased, the heat generated in the dielectric by the losses becomes of greater importance in the consideration of the maximum conductor temperature allowable for continuous practice.

When a steady state is reached under load conditions, with applied voltage V, there is a small leakage current flowing, c, and the heat generated in an elementary ring of the dielectric is $c^2 \rho\ dr/2\pi r$. Since the temperature remains constant, then—

$$\frac{d}{dr}\left(\frac{dT}{dr} \cdot \frac{2\pi r}{k}\right) = \frac{c^2\ dr}{2\pi r}\ \rho :$$

$$i.e.\ \left(\frac{dT}{dr} \cdot \frac{2\pi r}{k}\right) = -\left(c^2 \frac{\rho_1}{2\pi} \log_e r + H,\right);$$

$$\text{and } \therefore T_r = \frac{k}{2\pi}\left(c^2 \frac{\rho_1}{2\pi} \cdot \frac{\log_e r^2}{2} b_1 r + H \cdot \log_e b/r\right) + T_b.$$

$$\text{Hence} — \quad T_a = T_b + \frac{k}{2\pi} \cdot \left(H \cdot \log_e b/a + \frac{c^2 u}{2} \log_e b a\right).$$

T_b is the sheath temperature, H the heat flow due to the load; then if s represents the thermal resistance of the cable, G the thermal resistance of the soil and cable covering, and t the soil temperature, we have the following relations:—

$$T_a = T_b + Hs + V^2 s/2R ; \ T_b = t + (H + V^2/R)\,G :$$
$$i.e.,\ T_a - T_b = \theta_1 + V^2 s/2R : \ T_b = t_b + (V^2/R)\,G.$$

Since θ_1 is the range of temperature in the dielectric with load current only, we have $\theta_1 = t_a - t_b$; and the rise (x) in the conductor temperature due to the dielectric loss is then—

$$t_a - t_a = X = V^2 (s/2 + G)/R.$$

R, the dielectric resistance at the final temperature T_a, can be expressed as $R_a f/a^x$, R_a being the resistance at uniform temperature t_a:

$$i.e.,\ X = \frac{V^2}{R_a \cdot f/a^X}(s/2 + G), \text{ and } \therefore \frac{X \cdot f}{a^X} = \frac{V^2}{R_a}(s/2 + G).$$

The temperature factor f, as previously given, is $(a^{\theta} - 1)/\theta \log_e a$; θ, *i.e.* $(T_a - T_b)$, can be expressed as $\theta_1 + dX$, where $d = s/(s + 2G)$; and thus $f = (a^{\theta_1 + dX} - 1)/(\theta_1 + dX) \log_e a$.

The complete equation for the temperature rise due to the dielectric loss is then—

$$X\,(a^{\theta_1 + dX} - 1)/a^X \log_e a\,(\theta_1 + dX) = V^2(s/2 + G)/R_a \ . \quad (5).$$

For alternating current the power-factor equation will be:—$X f'/\beta^x = V^2 (s/2 + G)\ pK\ (S/p\ K)_a$: $(S/pK)_a$ is the power factor at uniform t_a . . . . . (6)

The rise in temperature produced by the losses can be calculated in this way; in practice, however—unless the loss be abnormal—it will have little effect upon the dielectric resistance, which, assuming a final maximum conductor temperature of 150 deg. F. in all cases, will practically equal that given by current loading alone, *viz.*, R f (R is the value for a uniform temperature t_a, of 150 deg). Under these conditions the equation for the temperature rise with dielectric loss becomes—

$$X = W\,(s/2 + G)/f = W_m\ (s/2 + G) ; \ W \text{ is the watts lost, } (V^2/R \text{ or } V^2 S) \text{ at } 150^\circ \text{ F uniform.}$$

Allowance has to be made in respect of current rating: if C is the maximum current—neglecting losses—for a final conductor temperature of 150 deg. F., and C_1 the permissible current, including all losses, then—

$$C_1 C = \sqrt{[(t_a - t)/(T_a - t)]} = \sqrt{\{[T_a - t - W_m (S/2 + G)]/(T_a - t)\}}$$

i.e., $C_1 = C\sqrt{[1 - X/(T_a - t)]}$: (normally $T_a - t$ is about 90° F).

High Voltage and Cable Design.

Although the relative values of the test and breakdown pressures have important bearings with regard to the question of design, in general we can consider that for h.v. cables* $a = V/v$, where a is the conductor radius and v the maximum allowable stress for continuous working at voltage V. If the same dielectric constitution is used in the manufacture of cables for increasing voltage and v remains constant (between 40 and 50 kV/cm. rms); since $v = V/(a \log_e b/a)$, then $\log_e b/a = 1$, and the mean gradient $V/(b-a)$ is also constant. The same maximum and mean stresses therefore exist in cables for various voltages under these condi-

* A. Russell: "The Dielectric Strength of Insulating Materials, &c." I.E.E. *Journal*, Vol. 40, 1908.

* C. T. Beaver: "Cables," I.E.E. *Journal*, Vol. 53, 1914.

tions, and the characteristic curves will be similar—assuming the dielectric to be homogeneous—in which case there will be the same value of resistivity and power factor to contend with at the working pressures.

Example.—Fig. 1 represents a cable designed for 40,000 volts a.c., with a maximum stress of 40,000 V/cm., in which case a is equal to 1 cm. and b to e cm. The same cable for d.c. will, on the max./rms ratio, be suitable for 60,000 volts approximately, at a maximum stress of 60,000 V/cm. The thermal resistance of this cable is 80, and that for the soil and covering is

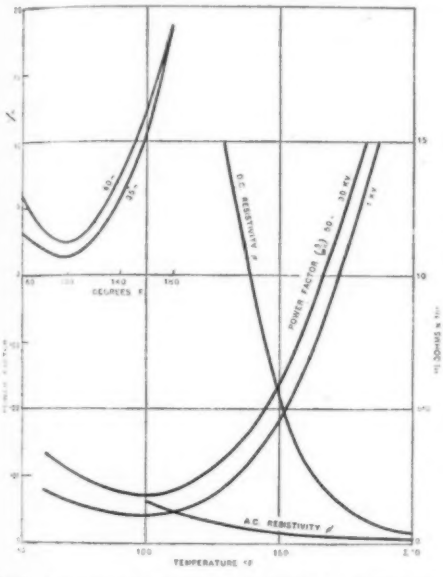


Fig. 2.—Characteristic Curves—Impregnated Paper Dielectric.

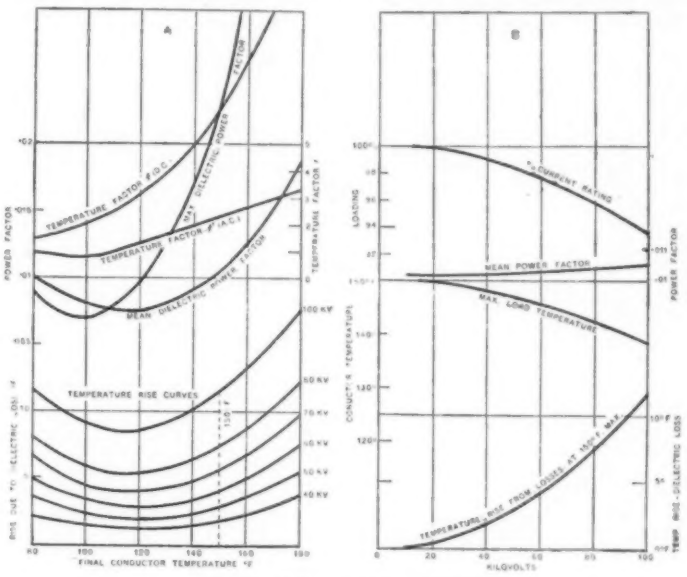


Fig. 3.—Voltage and Current Rating.

calculated to be about 60 (watt Centigrade units), as representing fairly normal conditions with a ground temperature of 60 deg. F.

It is assumed that such a cable can be run at 150 deg. F., and in fig. 4 curves are given showing the variations in some of the characteristics with changing temperature gradient. In the case of the d.c. curves (A), it will be observed that the potential distribution is greatly altered and the maximum stress entirely reversed by the temperature range prevailing in the dielectric. In this particular example the maximum potential gradient is 70 kV/cm. on the outer layers of the dielectric with the given conditions. With a.c. the potential distribution is practically unaltered by variations of temperature. The effect of dielectric loss in the case of d.c. is immaterial at a maximum temperature of 150 deg. F.; in regard to a.c. there is a rise of about 2 deg. F. with 40 kV, with consequent slight increase in the dielectric power-factor curve (B).

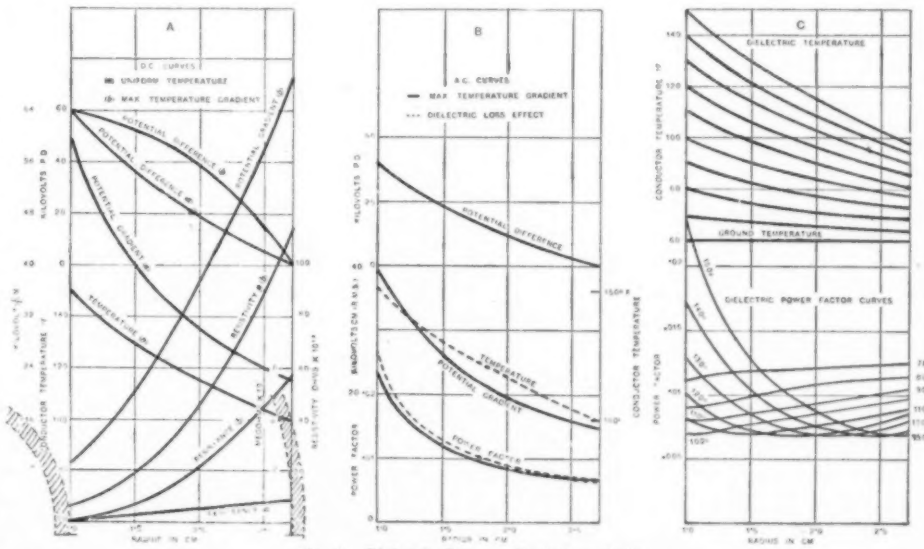


Fig. 4.—Dielectric Curves—Single-Core Cable.

Fig. 3 (A) shows the increasing rise due to dielectric loss with higher a.c. voltages, the rise being plotted against final conductor temperature; and (B) gives the necessary reduction in current rating to allow for the losses, in attaining a final temperature of 150 deg. F., for the various voltages.

These results will only be strictly applicable provided the same conditions in respect of potential gradient are observed, as the question of resistivity in relation to voltage has not been considered. That the dielectric resistance changes with the applied pressure—even at the higher temperatures—is evident from the two power-factor curves given in fig. 2, and under these circumstances the value obtained for the resistivity at any voltage is that corresponding to the mean potential gradient, and is the one contained in the various equations.

Hence, if the resistivity or power-factor curves are obtained for any cable at the required voltage and frequency with uniform temperature, the variations taking place within the dielectric for any conditions of loading can be ascertained as in fig. 4 (C), and the approximate mean value calculated for current rating purposes.

With a.c. cables for extra-high-tension, however, it seems probable—owing to difficulties in respect of size both as regards manufacture and general handling—that for voltages much above 60 kilovolts it will be necessary to increase the permissible value for the maximum potential gradient. If such be the case, the loss will be greater and the consequent temperature rise much increased, since in general the dielectric power factor will be higher in comparison with the figures given here. The matter is even more important in connection with the design of 3-core cables, which for pressures above 33,000 volts are almost out of the question unless greater dielectric stresses are to be brought into more

general use. A departure such as this is much to be deprecated, and it would seem to be attended by a certain amount of risk, so much is as yet unexplained in the behaviour of highly-stressed dielectrics. In particular, there is the debatable question of ionisation, which would appear to be present in some cables, but not in others—no doubt depending upon the degree of perfection attained in manufacture. No difficulty of this description appears to be experienced with well-filled cables having a maximum stress of about 40 kV/cm., but above this limit there seems a likelihood that ionisation may be present, although to what degree it is detrimental to the functioning of the cable, or what its ultimate effect upon the life of the cable will be, time and experience alone can tell.

Conclusions.

An investigation into the effects of temperature gradient upon the characteristics of impregnated paper dielectric leads to the conclusion that the dielectric loss of cables under working conditions can be represented by that produced at some uniform temperature, which for most cases of single-core cables in practice is approximately equivalent to the mean value.

With direct-current cable the dielectric loss is of little importance, but the maximum conductor temperature is limited by the value of potential gradient permitted in the outer layers of the dielectric, owing to the redistribution of potential taking place with temperature gradient.

For alternating-current cables the permissible temperature rise must depend upon the effect of dielectric loss; with 40 kV and over this cannot be ignored—even in single-core cables—and due allowance must be made in determining the current rating. In general, for single-core cables of normal design, a maximum temperature of 150 deg. F., including losses, does not seem to be excessive; this figure, however, to admit of reasonable factor of safety, must depend upon the question of the maximum potential gradient.

It is necessary for practical purposes to be able to foretell what the dielectric losses will be on h.v. cables under working conditions at temperatures corresponding to certain states of loading. In the factory attempts are often made to imitate running conditions—principally at maximum load when the losses are of chief importance—by means of current heating the cable conductors. Such a method, as a rule, can only be partially successful, since it is not possible to entirely create the varied conditions encountered in practice, and due allowances for this have to be made in the results obtained.

It is necessary both from the point of view of cable design and research work, that the characteristics of the impregnating materials should be obtained from time to time over a wide range of temperature, with varying frequency and voltage, and from the results some idea can be gathered of the probable behaviour of cables in practice. There is, however, a vast difference between materials as prepared under ideal conditions in the laboratory and those emerging as the finished cable after having passed through a host of manufacturing processes; and for a really accurate determination of the effects of voltage and temperature gradients on cables, it is essential to deal with the characteristics of a number of actual manufactured lengths—somewhat on the lines suggested in this article. A comparison of these methods affords useful indications with regard to the imperfection factor introduced by various impurities in the course of manufacture.

The Measurement of Electrical Service.

Some Suggestions for its Application.

By E. GRAHAM.

How can electrical service be measured?

The problem is uppermost in many minds. One of the most difficult things to do is to get hold of an idea of just how much service is being given by any stated person or firm. The customer has *his* ideas about it, and to him these are much more clearly defined than to the person giving the service. Were the reverse to hold, perhaps a better state of affairs might exist commercially, but then such conditions must change but slowly. To which end it must be noted that service can only be measured, to begin with, qualitatively. But it will be seen from what follows that the qualitative measurement soon becomes quantitative in a very real sense, and that, as a consequence, another industrial problem is offered a long-wanted solution, *viz.*, the satisfactory payment by results of staffs as distinct from manual workers.

Incidentally, it is possible, as a result of service measurement by the method to be outlined, to institute a means of tracing with some accuracy the effect of certain given circumstances, external to the servant firm, upon its activities. It is well known, for instance, that certain buyers, for reasons only surmised, are definitely prejudiced against certain makers' goods. The makers themselves are aware of the prejudice, would like to overcome it, but are unable to locate the source of it with any degree of accuracy. The sources of such trouble, it is thought, can be located fairly accurately as a result of the measurement of service given.

It is necessary to consider which portion of the electrical trade is most directly affected by service conditions. For plant above 200 kW in size, the maker deals only either with a consulting engineer or with a highly technical customer, this following, as a natural consequence, upon the amount of money involved, which may be anything from £600 upwards per driving (or driven) unit installed, and/or the responsibility attached should a serious hitch arise with the plant ordered. The semi-technical, or non-technical buyer here rarely trusts himself to deal directly with the maker; he wants to be sure in his own mind that he is getting a full and proper return for his heavy outlay. Hence he employs a skilled consultant to look after his affairs. The highly technical buyer, on the other hand, knows exactly what he wants and understands what the maker will supply, and is, therefore, well able to serve himself. So that, commercially, the condition of service, in the ordinary accepted sense, may be said not to apply to plant above 200 kW.

Again, considering plant below 1 h.p. size, the applications of this are more or less of a universal nature. Standardised production combined with the small amount of money at stake in individual instances has led to the marketing of small machinery designed for heavy mechanical service, and therefore usable with little adaptation for practically any kind of work. At the worst, the customer is hardly ruined if his plant should prove to be a "frost." Any service given here lies more in the sphere of the retailer than in the sphere of the maker, although the latter is, of course, the servant of the retailer to some extent.

The limits of practical service, then, may be said to be realised in the medium-powered section of the trade, *i.e.*, that part of the industry dealing with plant of from 1 h.p. up to 200 kW capacity, and the service there given affects (*a*) the maker, (*b*) the middleman, or middlemen (sometimes there are two, or even three), and (*c*) the user. Either (*b*) and (*c*) can be customers

of (*a*). Hence it will be best to consider, for the sake of the principle involved, how the medium-powered maker can measure his service. With suitable modification, the principle can be applied to the middleman.

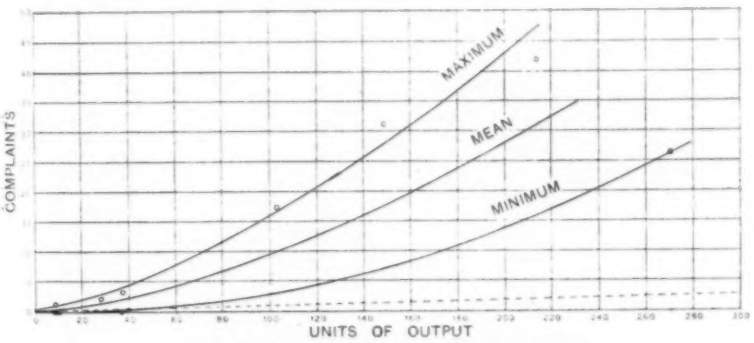
The medium-powered domain covers plant from simple units to the most complex arrangements of machinery, for almost every known industrial purpose; from coal cutters to cream separators, from mincing machines to printing presses and calenders. It is therefore necessary to make an analysis of sales to show a relationship between the type of customer and the mechanical power units (not the £ s. d.) manufactured, and the following analysis of a certain electrical manufacturer's sales of medium-powered dynamos and motors over the year 1924 gives a fair idea of the proportion of skilled, semi-skilled, and non-skilled minds involved in the aforementioned applications of the plant. The sales have been reduced to units of 25 h.p. output (or the equivalent kW), this unit being found to be the nearest to the result: total h.p. manufactured/total customers.

Sales to non-technical customers ...	493 units
Sales to semi-technical customers ...	270 units
Sales to highly-technical customers	167 units

These figures are now further sub-divided as follows:—

	Non-technical.	Semi-technical.	Highly-technical.
Users direct	270	149	28
Middlemen other than contractors ...	214	102	37
Consulting engineers	—	9	66
Contractors	9	10	36

The next step is to make a precisely similar analysis of *complaints of all kinds*, and in the present instance a collateral examination of letter, telegram, and telephone message records gave the number of complaints confirmed as 123.*



Curves showing the Ratio of Complaints to Output.

These dealt with anything from trivialities, such as "the pulley is one-eighth too large in diameter" to complaints of real breakdowns, prices, and demands for more suitable plant. They were apportioned as follows among customers:—

Non-technical	69
Semi-technical	48
Highly-technical	6

Actually, in addition, a few complaints were unconfirmed. Hence the figures for non-technical and semi-technical customers may be actually a little more evenly balanced. However, since the principle only is at stake, this is of no moment. Clearly, with other firms different figures must hold.

The sub-division gave:—

	Non-technical.	Semi-technical.	Highly-technical.
Users direct	26	31	2
Middlemen other than contractors ...	42	17	—
Consulting engineers	—	—	1
Contractors	1	—	3

If the foregoing figures now be plotted—complaints against units of output, as in the accompanying figure—using corresponding figures in the tables, two curves may be drawn through the limiting points so obtained, thereby giving a picture of the limiting numbers of complaints over the year. The value of these limiting curves will be referred to later. Meantime, as the figures themselves must vary from year to year, a mean curve drawn is sufficiently representative to serve two purposes, *viz.*:—

1. It shows, *by its shape*, whether complaints are increasing or decreasing in, or out of proportion with increase or decrease of output.
2. It serves as a means of obtaining a fair average value of the ratio complaints/customers applying to the *types* of customers among whom the sales were divided.

To consider these purposes it is necessary to draw a tangent to the curve at the lowest point.

1. If the slope of the curve continually increases, as in the example, then it clearly indicates that trouble with customers as a whole is increasing at a greater rate than the increase of output. That is to say, customers are less satisfied, *i.e.*, the *service* of the firm is falling off. Hence it is high time for the works' manager or managing director literally "to examine himself" and his organisation. Conferences may be needed to educate the staff in better pulling together; to teach them that unless they do so, and simultaneously pull with customers, the firm's reputation will not be saved, for the decrease in reputation is directly proportional to the distance between the curve and the tangent drawn. The further apart the two lines are, with the curve above, *the less the service being given*. The organisation is then such that conditions are not conducive to the giving of the best service, *e.g.*, there may exist discontent among the staff caused by sundry means, or it may be that delivery dates are not being adhered to, and therefore the progress side of the organisation may require looking into, which would cover an examination of order department, drawing office, foundry, stores, main shops, and dispatch department. If the slackness is not inside, is it outside? Are the agents, travellers, and outside technical men doing their bit to please the customers? If not, why not? and so on.

If the curve follows a straight line the service conditions are much more satisfactory. The same attention is then being given to each and every customer, whether that attention be wholly pleasing or not. Should the curve then make a decided angle with the horizontal axis, the service is *not* wholly pleasing. Yet it is sufficiently good to be classed as fair. There is, however, room for improvement, and an overhaul of the organisation would very likely prove to be an advantage. The greater the angle the greater the need for the overhaul. The ideal condition is that the curve will lie either on, or parallel to, the horizontal axis. Were this so, truly the manufacturer's life would be a happy one, as would also the lives of his customers and staff. However, human nature being as it is, it is to be feared that few firms are able to record a perfectly horizontal line.

The curve further provides a means of applying a satisfactory system of payment by results to the staff as a whole, on the basis of the amount of service done. It is possible to fix a definite percentage increase or decrease in salary dependent upon the shape of the curve. This percentage can be easily enough fixed, for the curve will be of some general order, say, in the present instance, $y = ax^n + b$. A calculated curve can be drawn so near the actual average curve as to make any difference negligible. Hence it is possible to reckon actually the *quantitative improvement* in the firm's service, as distinct from the qualitative one, and so fix a "gang bonus" system of payment by definite results, which will be far more accurate and satisfactory than the usual "bonus on output." The latter does not meet the service condition at all, since it only affects the inside and purely personal part of the business. The

* In obtaining these data, confidential information called for an alteration of the true number of complaints. The number, therefore, has been altered, but the *proportion* of them among the customers has been adhered to.

service bonus (or penalty, as the case may be), on the other hand, takes into consideration *all* the firm's activities. The counter hand dealing with a difficult caller is placed on exactly the same footing as the secretarial man replying to a particularly nasty letter, and *vice-versa*. By giving bad service any employé is penalising the whole staff, who, when working as a team, soon become able to look after such matters exclusive of managerial intervention. Both internal and external conditions, therefore, are properly catered for, since, if the service improves the output will improve, which is really the ultimate end of every system of payment by results. The actual percentage payable, or to be deducted, as the case may be, would, of course, depend upon the oncost and production conditions of individual concerns, but the main thing to be noted is that the *basis* of the system can be found by an earnest consultation of records to be found in any concern. If no records of complaints have been previously kept, it is feasible enough to start off by keeping careful note over three months, say, and correct the curve every three months until a sufficient amount of data is available to give a more authentic graph.

It should be noted, too, that the bonus is practically independent of either trade depression or boom, and is therefore fair in operation. In times of depression staffs generally are reduced, the service payment (total amount) being reduced in proportion to the staff reduction only, thus still leaving the *same incentive* to the remainder to keep on exerting their energies, and not increasing the cost per unit of output. With the purely output bonus, the amount paid decreases independently of the number of staff hands, thus killing the incentive to work hard at the time when hard work is most required.

Before passing on to the consideration of 2, it should be observed that the limiting curves are of use in another manner. It is customary for auditors, when checking books, to permit a firm to charge back on to the previous year any work done in the following year under guarantee or otherwise free of charge to meet customers' complaints respecting plant despatched in the year just closed. The amount to charge back is very difficult to estimate at the time the books are being audited, and in many instances a figure is " jumped " which is likely to contain a serious error. Now any such work will, because of its nature, be largely proportional to the mean curve drawn, but the nature of the year's complaints will indicate broadly whether, in terms of £ s. d., it is more nearly proportional to either of the limiting curves. Hence an estimate of the coming year's probable output will be referred to whichever curve is thought to apply, and a figure obtained with reference to which a fair back charge can be reckoned. The difficulty is generally to know the limits between which to fix the back charge, but if the charges for, say, three or four previous years be averaged and referred to the mean curve, the limits are fairly accurately obtained.

2. The curve provides a means of obtaining a good idea of the effect upon a firm's transactions of the type and class of customer dealt with. If the ratio, complaints/customers be reckoned from corresponding figures in the tables, the following results hold:—

Semi-technical direct user	.208
Non-technical middleman	.196
Semi-technical do.	.1665
Non-technical contractor	.111
Do. direct user	.0964
Highly-technical contractor	.0835
Do. direct user	.0714
Do. consulting engineer	.0151

Corrected to meet the average curve these become:—

Semi-technical direct user	.141
Non-technical middleman	.155
Semi-technical do.	.109
Non-technical contractor	.031
Do. direct user	.130
Highly-technical contractor	.053
Do. direct user	.045
Do. consulting engineer	.031

These figures are very useful in affording a means of locating approximately, in certain circumstances, sources of certain adverse conditions, such as, say, definite negative propaganda. Suppose that in a given district continual complaints arose showing strong similarity. Adding them and reading along from the total to the curve, provides a figure from which a ratio can be calculated, thereby giving an indication of the *type* of customer to whom the plant was sold. Then, since the complaints come from one general district, activities are immediately concentrated upon keeping a strict observance on all such typical customers in the district. Local agents and others are warned to keep ears and eyes open particularly with respect to those customers, and to report the least thing at all suggestive. Meanwhile, another curve is made out in the same way by dealing solely with the complaints and plant distributed among the typical customers concerned, these folks being sub-divided, in their turn, into certain classes or types as accurately as possible. (Thus it would be insufficient here to use the designation " contractor." The customer must be designated more definitely, as " plumber-wireman," " motor engineer," and so on, as all these people label themselves as " contractors " whether entitled to do so or not.) The *shape* of this second curve will then point out the source of the trouble almost right away. If the slope increases, the trouble is located among the larger buyers in the district; if the slope decreases, then among the smaller buyers. A careful scrutiny of the agents' and travellers' reports will confirm almost exactly where the trouble originates. The process is simply a detective one involving logical stages of elimination of conditions not affecting the general adverse one, and other applications of the principle will suggest themselves to individual readers. It is not claimed to be infallible, far from that; but it is thought to have a useful sphere in circumstances similar to that indicated. An actual instance wherein it would have proved useful was concerning many complaints received by a firm supplying ball-bearing motors. Only by chance it was discovered, long after, that the motors complained of were all supplied through a shady middleman who had replaced the original ball bearings by inferior ones. Had some such curve as has been suggested been employed, it is likely that the trouble would have been located within a very short time of receiving the complaints.

A further typical application of the process is where a maker supplies only through a large number of recognised agencies. His output would be divided per unit area of territory, and records would show whence complaints came and their number. The plotted curve would then show with fair accuracy where, among the agents, something existed which required looking into.

Thus, consideration of the principle involved in these remarks will show that it may be put to many uses distinct from, but yet directly dependent upon the measurement of service, and if, in virtue of its versatility, the principle can of itself offer a real service to the electrical trade (as well as to any other trade), why should not use be made of it? Measuring service, it measures quality; measuring quality, it measures status, and as a measure of status it is a definite measure of market pulling power.

Electric Automobiles in France.—As a result of the trials which have been held during the last few years, a steady increase is taking place in the use of industrial electric automobiles in France. The Société pour le Développement des Véhicules Electriques—an association of electricity-supply and other interested undertakings—is also assisting the movement by improving the battery charging facilities in France. As a result of its activities it is stated that there are now fifteen stations in Paris alone where the charging of vehicle batteries for private owners of electric trucks is undertaken.

Water-Power Development in Uruguay.—The *Review of the River Plate* says that the Uruguayan Minister of Public Works was interviewed recently by representatives of J. G. White & Co., who stated that that firm would be interested in financing the projected development of the Rio Negro for hydro-electric purposes.

The Wireless Exhibition, 1925.

An All-British Display of Radio-Telephone Apparatus and Accessories.

THE third exhibition of radio-telephone receivers and component parts organised by the National Association of Radio Manufacturers and Traders, and the second to be staged in the Royal Albert Hall, was opened to the public on September 12th for a period of ten days. Since the last show the words " . . . and Traders " have been added to the Association's name, thus enlarging its scope when but little more than two years old, and it is therefore only natural that the number of exhibitors of apparatus should show an increase of 50 per cent. on last year's total of 44. Being the largest and most important function of the year in the radio world, the show may be regarded as an index of the development and progress of the past 12 months.

The fact that it is just 30 years since Guglielmo Marconi made his first successful wireless signals adds interest to the occasion, and to celebrate the event the N.A.R.M.A.T. gave a luncheon in honour of Senatore Marconi at the Savoy Hotel on Friday last. The chairman, Mr. W. W. Burnham, chairman of the Association, proposed the health of the principal guest, who, he said, had more than held his place in the ranks of wireless inventors. British broadcasting was the best in the world, and a large amount of capital had been invested in the British wireless trade, employing many thousands of workers. The Association desired to keep the trade in British hands, to promote British trade, and to keep foreign wireless wares out of the country.

Senatore Marconi responded, expressing his great satisfaction at the progress that had been made ince he made his first experiments. He at first followed on the lines of Hertz, Lodge, and Righi, using very short waves and metallic reflectors, with which in 1895 he succeeded in telegraphing over a distance of 1¾ miles; the waves, less than one metre in length, could not overpass obstacles such as houses and hills, but he tried the effect of connecting his oscillator to a vertical wire and an earth-plate, and was then successful in obtaining reliable transmission quite unaffected by intervening obstacles. This was essentially a broadcasting system, and became the basis of all systems of long-distance radio communication. Describing further developments, he expressed his gratitude to the late Sir W. H. Preece, and to the Post Office authorities, for the help and encouragement that he had received from them. The wonderful progress that had since been made was rendered possible by the patient work of a host of investigators the world over, including his own assistants and the great radio and manufacturing companies.

Mr. R. Ferguson, proposing prosperity to the British Broadcasting Company, said the Association was proud of its sister organisation, and, referring to the Committee of Inquiry that had been appointed, he expressed the hope that there would be continuity of policy.

Mr. J. C. W. Reith, managing director of the B.B.C., responded, and pointed out that whatever was done by the B.B.C. in the interests of the public was bound, in the long run, to benefit the trade also. A new trademark for British goods was to be registered shortly, for use by members of the company. He heartily welcomed the Committee, and promised the fullest co-operation of the B.B.C.

Mr. W. H. Goodman proposed the health of the guests, and stated that not only British broadcasting, but also British apparatus, was the best in the world, judging by the foreign demand, which could not always be fully met owing to the heavy internal demand.

Capt. Ian Fraser, responding, said that when he was abroad recently he found that British stations were listened to very generally, and that it was held that the best musical programmes were received from Daventry and other stations in this country.

The Exhibition was opened on Saturday last by Viscount Wolmer, Assistant Postmaster-General, and has been visited by a large number of people during the past week.

Mullard Radio Valve Co., Ltd.

Amongst the comprehensive collection of the products of this company over a dozen types of receiving valves are displayed and h.f. and l.f. and the dull-filament power valves are the most recent additions to the firm's series. A dull-filament power amplifier of special interest is the P.M.4, illustrated in fig. 1. It has a filament of high emissivity which needs only 0.1 amp. at from 3.5 to 4.0 volts to heat it. The low temperature at which the filament works reduces the microphonic noises often obtained when using dull emitter valves with very thin filaments. The range of transmitting valves shown is even larger; a 5-watt pattern is available for the novice and

Fig. 1.—New Mullard Dull Power Valve.

Fig. 2.—New Mullard Anode Resistance.

a 30,000-watt valve as used in large stations is to be seen, whilst a dozen valves of intermediate powers are available. The transmitters from the 5-watt up to the 500-watt size have glass bulbs and those of higher-power valves are silica; the 30-kW valve is a metal-glass one and glass, silica, and metal-glass rectifier valves, of which 12 types are available, are made to work in conjunction with the transmitters. A new anode resistance recently developed by the company is also on view, fig. 2; it is entirely wire-wound and is claimed to be absolutely constant under all conditions of reasonable use. The substitution of wire for the usual carbon resistance element greatly increases the current carrying capacity of the resistance and also eliminates the noises usually associated with carbon anode resistances. Condensers to work in conjunction with these resistances for detector valves are also on view.

Radio Instruments, Ltd.

This exhibit is divided into two sections, *viz.*, complete sets and accessories. The new receivers are now all enclosed in mahogany cabinets, all the terminals being at the back with a door at the rear of the instrument to give access to the valves. Reaction is employed in every case, and dual rheostats of the pattern recently illustrated in our pages are fitted to all receivers so as to give the user the choice of either dull or bright valves, as desired, without the set needing modification.

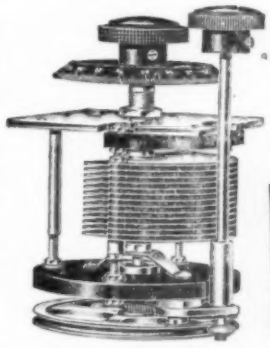


Fig. 3.—" R.I." Geared Condenser.

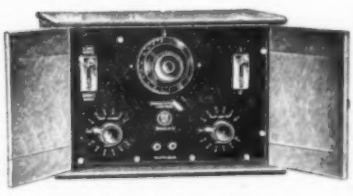


Fig. 4.—" R.I." Crystal and 2-Valve Amplifier.

In addition to " R.I." components, such as transformers, loudspeakers, &c., which have been on view before, there is to be seen a new geared condenser for very fine adjustment, having a gearing ratio of 11 to 1 (fig. 3). The method of gearing is new and obviates backlash; a small fibre pinion presses against a large grooved aluminium wheel and the friction between the two ensures a positive movement and precision tuning. The plates are of hard brass sheet. The firm's super-heterodyne components comprise two forms of oscillation couplers, one being complete with its variable condenser; the other, a somewhat less expensive unit, is for use with a separate variable condenser. A filter unit is made which gives efficient

results on about 6,000 metres, and the company also shows super-heterodyne transformers tuned broadly to the same wavelength as the filter unit. The company is now producing several different types of crystal sets, each including the permanent mineral detector which has been described in our columns. In addition to a comparatively cheap set with crystal detector only, two new instruments are being placed on the market, the permanent detector being used in conjunction with single and double-stage note magnifiers. These instruments are designed with a view to simplicity in operation; both crystal and valves are contained in the back of the instrument as shown in fig. 4 and are accessible by means of a hinged door. A switch is provided for cutting in or out the station at Daventry, and the cabinets are of polished mahogany. Valve detectors are made in three types and enclosed in cabinets very similar to the crystal-amplifier unit. One type comprises a valve detector in conjunction with a single-stage note amplifier; another has a two-stage note amplifier, and each possesses a range of from 300 to 4,000 metres. A pedestal base is provided for housing dry batteries and a third type is fitted with a more elaborate cabinet and has the advantage of an additional stage of h.f. amplification. In all three instruments where valve detectors are used, limited variable aerial reaction is provided by means of the "R.I." retroactive tuner. Note amplifiers are made in two sizes, one having a single stage and the other two stages.

A. J. Stevens & Co. (1914), Ltd.

This firm's productions include two, three, and four-valve receivers in walnut cabinets, and amongst the pedestal cabinets is a new Louis XIV. Renaissance model. The use of multi-valve switches enables some of the valves to be dispensed with. Amongst the amplifiers shown is the "Concert" model with tone, grid bias, and volume controls. In the loud speaker range are included new models of the pedestal,

Fig. 5.—"A.J.S." Cabinet-type Loud Speaker.

Fig. 6.—"A.J.S." Loud Speaker.

cabinet (fig. 5) and "Junior" speaker (fig. 6). Components are exhibited and an "A.J.S." headphone is now put on the market for the first time. The firm is also showing its new tubular steel telescopic masts in two sizes, measuring respectively 35 and 50 ft. when erected, and 18 ft. 3 in. and 19 ft. 6 in. nested for transit. No erecting gear is required, climbing is obviated, and the whole structure is complete with base plates angle-iron ground pegs, guy wires fitted with strainers and insulators, aerial pulley, &c. Amongst the components exhibited were plug-in coils encased in ebonite, making a very solid job, a low-loss condenser, and a new choke unit.

Radiax, Ltd.

This exhibit consists of complete receiving sets of various patterns and a multitude of accessories, including sets of super-heterodyne components. A small condenser which is variable over a large proportion of its capacity should be very serviceable, and a new "low loss" loop aerial was shown which

Fig. 7.—Radiax Loud Speaker.

provided with tappings to enable ready adjustment to be obtained and to permit the use of capacity-controlled reaction. The non-resonating horn of the "Radiax" loud speaker, fig. 7, has a crystalline finish and the magnets are of cobalt steel. The diaphragm is adjustable by a method which is claimed to maintain parallelism between it and the magnet poles, and the terminals are mica insulated. The speaker illustrated is 19 in. high, the "Baby" pattern being 12½ in. high. The latest novelties on this stand were the "Cartrodenser" components—a new series of fixed condensers and grid leaks ("cartroleaks"), in the form of cartridges. Low-loss coils were also shown.

British Thomson-Houston Co., Ltd.

Amongst the newer developments of the company's crystal, crystal-valve, and multivalve sets, is the receiver shown in fig. 8, which is housed within a polished walnut case, the two valves being sunk beneath the panel. The circuit embodied is that of a detector valve followed by one stage of low-frequency amplification, reaction being provided by means of a

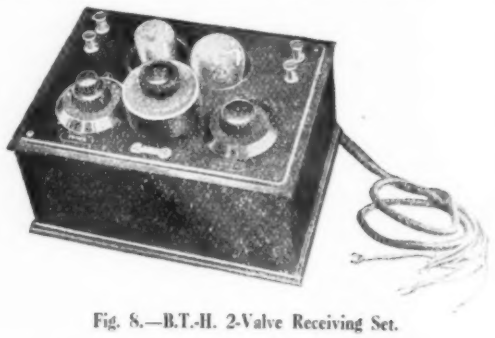


Fig. 8.—B.T.-H. 2-Valve Receiving Set.

specially designed form of plug-in aerial-loading coil and reaction unit. One feature is that no re-adjustment of the aerial-tuning condensers is required when the amount of reaction is varied. The tuning condenser enables fine adjustment to be made and all the battery connections are brought out from the back of the receiver in the form of a braided cable, duly tagged to facilitate connecting up. A variety of valves, loud speakers, and amplifiers, is shown with headphones and other

Fig. 9.—New B.T.-H. l.f. Transformer.

components, whilst a new product of interest is the l.f. transformer illustrated in fig. 9. Characteristic curves of this transformer are reproduced in fig. 10. The new component is protected by a casing of brown moulded insulation material, giving it a neat appearance; although comparatively small in size, it is robust, and is obtainable in two ratios—4:1 and 2:1—the former being recommended for use in the first and the latter in succeeding stages. It is essential, the

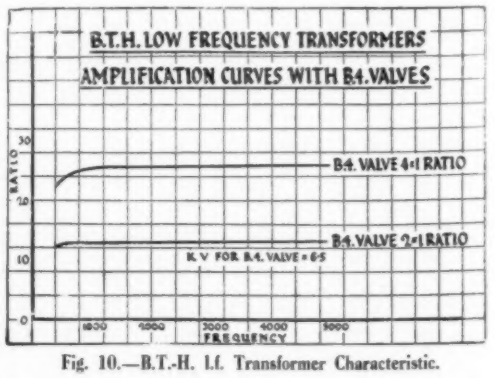


Fig. 10.—B.T.-H. l.f. Transformer Characteristic.

makers point out, that the correct battery voltages be used; if very loud reproduction is desired, a negative grid bias of 4.5 V and an anode voltage of about 120 V should be employed. A new hornless loud speaker, having a diaphragm 10 in. in diameter, of non-hygroscopic material and free at the periphery, is a specially interesting exhibit.

(To be continued.)

The Municipal Tramways Association—I.

Annual Conference at Brighton.

THE annual conference of the Municipal Tramways Association was held at Brighton on September 9th, 10th and 11th, under the presidency of Alderman C. Higham (chairman of the Blackburn Tramways Committee). The usual practice of holding the conference in the town with which the president is connected was not followed this year, owing to the lack of hotel accommodation in Blackburn. Some 350 members and 140 ladies were present, and an informal reception, followed by dancing, was held on the Tuesday evening at the Hotel Metropole.

The conference was held in the Music Room of the Royal Pavilion, and on Wednesday, September 9th, the members and visitors were welcomed by the Mayor of Brighton (Alderman C. J. Teasdale, J.P.), who was accompanied by the Mayor of Blackburn (Councillor J. Stanworth, J.P.). In the course of his remarks, the Mayor of Brighton referred to the question of the tramcar *versus* the 'bus. In a pleasure town such as Brighton, he said, they could probably do without the tramways, but they could not scrap them owing to the large amount of money invested in them. Both the 'bus and the tramcar had their advantages, but for each tramcar scrapped, two or three 'buses would be needed.

A vote of thanks having been accorded to the Mayor for the cordial welcome he had extended to the conference, Alderman C. Higham delivered his presidential address, of which an abstract is given below.

Alderman J. S. PENDLETON, J.P. (member of the Nottingham Tramways Committee), who proposed a vote of thanks to the President for his address, supported him in his attitude of protest against the unfair competition which tramways had to meet, not only from outside people on the road, but very often from the Ministry of Transport, who ought to be out to help municipal tramway authorities in their public activities. He criticised the officials of the Ministry for their attitude of mind in the Parliamentary committee rooms when municipalities were seeking further powers, and said they seemed to seize every opportunity of curtailing the activities of the municipalities. That was not what the Ministry of Transport was for, and he considered it was time a protest was made against it. He also criticised the indiscriminate granting of omnibus licences by Watch Committees. The Tramways Committees did not get the help from Watch Committees which they ought reasonably to expect.

Alderman Sir PETER PEACOCK, J.P. (chairman, Warrington Tramways Committee), seconded the vote of thanks, which was duly accorded.

Afterwards a paper was read, "Municipal Tramways and Motor Omnibuses," by Mr. A. R. Fearnley, general manager, Sheffield Corporation Tramways and Motors, and the discussion was carried on until the conference adjourned for luncheon in the Dome, at the invitation of the Mayor of Brighton.

The PRESIDENT proposed the health of the Mayor, and again expressed the thanks of the Association for the manner in which the Corporation and its officials had worked to make the conference a success. The MAYOR OF BRIGHTON, responding, said that even the inhabitants of Brighton did not know what a valuable undertaking they had in their tramway undertaking, because they did not take enough interest in it. A sum of £300,000 had been invested in the undertaking, and half that sum had been paid off, leaving a debt of £145,000 outstanding. Since the war £50,000 had been spent on track renewals, and scrapping the system was out of the question. The gross profit last year was £27,000, out of which interest and sinking fund charges had to be paid, but if the undertaking had been in the hands of a company, it would have been able to pay a dividend of 13 per cent. on ordinary shares, 6 per cent. on preference shares, and 4 per cent. on debentures.

After luncheon the discussion on Mr. Fearnley's paper was concluded, and a paper was read on "Tramcar Stopping Places," by Mr. Jas. Dalrymple, general manager of the Glasgow Corporation Tramways.

(To be continued.)

Presidential Address

By MR. ALD. CHARLES HIGHAM.

(Abstract.)

IN spite of the splendid enterprise of the "Safety First" Association, and the activities of others in warning the public of traffic dangers, there is a most alarming increase in the number of street accidents in this country—both fatal and non-fatal—and an amazing reluctance to take drastic remedial measures. The mechanically-operated road traffic of this country is now slaying yearly as many persons as form a large village community, and maiming or injuring more than dwell in the largest non-county borough in the country. The increase during recent years of mechanical vehicles, and especially those of high speeds, is entirely responsible for this terrible tale of sacrifice.

For some time this Association has called attention to it, and requested that there should be more effective regulation of street traffic, especially at tramway stopping-places. Even the Ministry, whose sole concern is with the supervision of transport, refuses to move. We must rely on an informed public opinion to take up this pressing question.

For the congestion of streets by traffic, especially in the centres of cities and towns, it has been suggested that the remedy may be found in excluding tramways from central areas. Some of these traffic experts have not yet noticed that considerable street congestion arises from rows of motor-cars on each side of the road.

The luxury motor-car has much to answer for, no doubt. Every petrol machine that displaces an electricity-driven one provides more employment for the workers in the oil-fields, but inevitably diminishes employment for the British miner, and accentuates industrial depression at home. We must persist in resisting any proposals for adding unnecessary vehicles to the streets.

Many municipalities which provide an adequate passenger service have been occupied during the year in defending their undertakings from mere exploiters. The time has arrived for a calm survey of the whole field of road passenger transport agencies and the relation that tramways bear to them. Whatever may be the means employed for the conveyance of those who must travel by road, local authorities will never hand over that great public service to private hands. Local authorities can be depended on to adapt the means to the end, and if inter-urban services are required they will be under public control. Recurring attacks are made on tramways by a section of the Press, which is not very scrupulous and has little regard for veracity. In July last, it was twice stated that Leeds and Walsall had decided that tramways were obsolete and had replaced them with other methods of transport. At the moment that was written Leeds had decided to spend about £400,000 on new tramcars and was extending the system. There was no truth in the statement that Walsall had decided to scrap tramways.

The Ministry of Transport has informed the Council that it does not share the opinion that tramways are obsolete. It is certain that the public does not share that view. Some motorists may think that tramways are a nuisance to them, but they forget that they themselves are a much bigger nuisance and danger to the public.

The tramways last year carried more than 4,443,000,000 passengers. The average receipt per passenger was 1.53d. compared with 1.05d. in 1913-14, or an increase of 46 per cent. only. They provide the cheapest and most constant means of transport. Moreover, they are, when taken in the aggregate, a sound commercial proposition.

The London and Home Counties' Traffic Advisory Committee has made its position clear. At a public inquiry as to omnibus traffic in restricted streets in London, on June 22nd, the Chairman, Sir Henry Maybury, said:—"I am desired by the Committee to state, with a view to conserving time, that they have decided that the intention of the Act of Parliament, Section 7 (1), (b), is that protection should be given to tramways and they propose to give such protection. Accordingly, they do not desire to hear evidence upon the question of this policy which, in their view, is not before them. It is an instruction of Parliament; it is an Act of Parliament, and the Committee are instructed to have regard as you know, to the services already provided on every route, and they must so consider."

It has been stated that not one of the London daily papers reported this important pronouncement.

The decision and report of the Special Tribunal appointed by the National Council to deal with the Employés' application of

May 16th, 1924, for a substantial increase in wages was issued on November 1st, 1924. The report was accepted unanimously by both sides, and has been in operation since November 18th, 1924.

In July last, the terms of the constitution of a new Workers' Alliance were published. The Unions representing the employés on the National Council were said to be parties to it. Clause 9 laid it down that:—"The conditions of membership of this alliance shall involve the allied organisations in definitely undertaking, notwithstanding anything in their agreements or constitutions to the contrary, to act as directed by the general conference of this alliance." It would appear, therefore, that agreements within an industry will no longer provide any effective security for the peace of that industry, and that on the employés' side they may be flung among the mere scraps of paper at any moment.

Annual General Meeting.

The annual general meeting was held on Thursday afternoon, September 10th.

It was announced that Mr. A. L. C. Fell, late general manager of the London County Council Tramways, had been elected an honorary member of the Association.

Mr. FELL, who was present and was accorded a very hearty welcome, addressed the meeting, and after expressing his thanks for the honour that had been done him, said that he agreed with Mr. Fearnley that tramways hitherto had been ill-treated, and he believed that if they were only given a chance and were relieved of some of the unjust burdens which were now imposed upon them, there would be no better means of transport in the world.

The resignation of Mr. A. Baker, of Birmingham, as one of the Association representatives on the Joint Industrial Council, was announced, with regret, and a hearty vote of thanks was accorded him for his services ever since the Joint Industrial Council was formed.

The annual report of the Council was then taken.

The meeting confirmed the Council's recommendation to change the name of the Association to the Municipal Tramways and Transport Association (Incorporated).

Mr. E. H. RAYNER (General Manager of the Hull Corporation Tramways) moved a resolution to the effect that the Council should consider the advisability of itself promoting a Bill giving local authorities the wider powers with regard to the running of motor 'buses which had been mentioned several times during the Conference.

The PRESIDENT explained that although some members of the Council thought the Council had power to promote such a Bill, the matter would have to be thoroughly investigated.

The proposal that the Council should inquire into the position with a view to the promotion of such a Bill was carried by a large majority.

The election of President and Vice-President for the ensuing year resulted in Mr. P. Priestley (General Manager of the Liverpool Tramways) and Mr. R. L. Horsfield (General Manager of the Cardiff Corporation Tramways) being chosen for the respective positions. Mr. A. R. Fearnley (Sheffield) was elected honorary treasurer. Alderman Canby (Huddersfield) was elected to the Council, as well as Messrs. J. K. Bruce (L.C.C.), J. F. Cameron (Northampton), C. Furness (Blackpool), R. S. Pilcher (Edinburgh), Owen Silvers (Wolverhampton), and N. J. Young (Newport, Mon.).

Votes of thanks to the retiring president and members of Council and the Corporation of Brighton concluded the meeting.

Municipal Tramways and Motor Omnibuses.

By MR. A. R. FEARNLEY, M.Inst.A.E.

(*Abstract.*)

The relative position of motor omnibuses in connection with tramways, in the road passenger transport systems in the country, is the most important question before municipal transport operators at this date. The claim of the municipalities is that the control of this traffic must remain in their hands, and that the question of the type of vehicle to be used for the purpose provides no justification, nor even a flimsy excuse for the attempts which have been made to take from them the control and handling of this public service.

The provision of public transport service is to-day equally as important as the provision of electricity, gas, water and other public services, which enter so largely into the every-day lives of the people. A public transport service must make provision for the people who live in the urban and rural districts, to have regular and ready means of access to the towns, so that they may get to and from their work and also have the benefit of the many valuable facilities provided in such areas. Having provided for these, there is a still further duty and responsibility upon the public authority, which is to see that the people who reside in the thickly populated areas have provision made for them so that when time and opportunity offer they can with ease, regularity and certainty, and at reasonable cost, get out of such areas into the healthy country districts and heights surrounding the towns and there enjoy the freedom and freshness of the country. It is obvious that these requirements cannot be adequately met by a system of transport which is tied to a rail or tied to a wire; both such systems have their proper spheres of operation.

Tramways have not suddenly developed any serious defect or weakness—the present cost of construction, renewals and repairs is a handicap, but one which could be met and overcome if nothing more serious required to be dealt with. The defect, that is, lack of mobility, was not so obvious a handicap prior to the great increase in all forms of motor traffic, but it is now a point which is being put forward and magnified on every possible occasion as a serious disability and one that cannot be got over. On occasion, apparently, the tramcar may obstruct other traffic, but when rightly considered it can be demonstrated that really it is assisting such traffic, as statistics for almost any district will readily show. Tramways are still the premier form of street transport for the large industrial areas. No one is yet able to demonstrate anything to the contrary, and one's own daily experience proves beyond question the correctness of this assertion. That other services, however, are required and that other forms of transport can best give such service, does but lead us to the declaration that it is vitally necessary in the public interest that such additional services should be retained under the public control, and provided by the tramway authority which, by co-ordinating the newer and more mobile vehicle with the well-established and still necessary public tramway service, can best meet all the requirements just outlined.

It should be readily granted that every municipality which has accepted the responsibility for street passenger transport operation should have powers to operate, develop and extend motor omnibus services. Where such a system can join up with the systems of other municipalities, arrangements should be made for the joint operation of through services between the various centres, and, if necessary, joint boards or committees appointed and the various systems operated and co-ordinated under their control. By such an arrangement the people will ultimately obtain better services and facilities than in any other way.

Can tramways exist alone on the central and short-distance runs? Their competitor is improving and becoming more efficient every year, and in time even the comparatively short routes will be attacked. The advent of the double-deck top-covered motor omnibus has changed the position of affairs so far as the comparison with tramway operation is concerned. This type of vehicle seats 52 passengers in an excellent manner, provides easy and comfortable riding, and maintains a high average scheduled speed. At the Conference in Dundee in 1919, figures were given showing the comparative costs of operating tramways and motor omnibuses, and these are now supplemented by the figures for the present year. The decrease in cost per seat provided on the motor omnibus is worthy of special attention. The figures are taken from a route on which the 52-seater type of motor 'bus has replaced a tramway.

Comparative Costs of Operating Tramcars and Motor Omnibuses.

Figures given at the M.T.A. Conference, 1919:—Working expenses, per seat per mile run: tramways, 0.230d.; omnibuses, 0.532d.; excess of omnibuses over tramways, 0.302d., or 131.3 per cent.

Service of debt: tramways, 0.031d.; omnibuses, 0.027d.; difference, 0.004d., or 12.9 per cent. less. Total: tramways, 0.261d.; omnibuses, 0.559d.; excess of omnibuses over tramways, 0.298d., or 114.1 per cent.

Figures based on four months ended July 18th, 1925:—

Working expenses: tramways, 0.195d.; omnibuses, 0.248d.; excess of omnibuses over tramways, 0.053d., or 27.2 per cent.

Service of debt: tramways, 0.033d.; omnibuses, 0.042d.; excess, 0.009d., or 27.3 per cent. Total: tramways, 0.228d.; omnibuses, 0.290d.; excess, 0.062d., or 27.2 per cent.

At the coming exhibition of commercial motor vehicles (which should be visited by every tramway operator in the country) more efficient engines, improved low frame chassis, wide track, improved brakes, provision for higher speeds, and good coachwork, with comfortable seating accommodation, are to be put forward for our acceptance. It is to be hoped that a great improvement in springing will also be available, otherwise the advantages outlined will be seriously discounted. People in the dense traffic areas will in time find systems thus equipped highly attractive and press for such services, maybe, as supplementary to existing tramways. It is apparent to everyone taking observations that the demand is clearly for transport facilities to go much farther afield than formerly, and as tramway owners and operators we have attempted to overcome the opposition and serious difficulties placed in our way, in order that we may meet this obvious requirement. The reliability of the vehicle cannot be questioned. We have not been limited in our views and observations by what has taken place in our own localities. We bear in mind the lesson taught in the early days of electric traction which, in numerous instances, has only been put right by expensive purchases out of municipal funds. We also profit by the astounding confusion that has been allowed to grow up under close and constant observation in the great metropolitan area of London. The best results are being obtained by those municipalities which have taken a long view of their responsibilities, and have seen that, having got the right to operate in thickly populated areas, they have not cleared themselves of their responsibilities, but must also provide for the more thinly populated districts, not merely for profit making, but with a view to providing what is now an obvious public necessity. Every town should have the clauses giving it the right to enter into through-running agreements, and those towns which have such clauses might profitably consider the advisability of at once acquiring and operating the small independent services which have been started in their neighbourhood. Unless this is done the trouble, difficulties, and great expense brought about by allowing big companies or combines to get hold of such services, as in the early days of electric traction, will be repeated.

In what way can this loss of attractiveness be countered? Cars can be speeded up; nothing less than 50-h.p. motors fitted on all cars which it is intended to retain in regular service for any length of time; power brakes fitted which can control the cars under the increased speeds with ease and without objectionable shocks to, or the throwing of, passengers; ventilation, which in numerous cases is insufficient, might have immediate attention; and clean, comfortable, well-lighted, attractive, and up-to-date cars provided. It may be advisable for employés to be reminded that having entered municipal service, smartness, alertness, promptness, and courtesy are required; that every pedestrian is a possible customer, and that we are all out to sell car sides; that the title of municipal tramways and transport undertaking is "The Sign of Good Service" and that we intend to exist as transport undertakings on our merits in serving the public.

Motor omnibuses should to-day be in general use by all tramway systems for :—

(1) The provision of services in thinly populated areas. The traffic from many such districts is astonishingly good at week-ends, and sufficient to bring up the total receipts to a point covering all operating expenses. When any such services are taken over from small owners by the Corporation, the traffic quickly improves as the reasonable charge and regularity of the municipal service become known.

(2) Providing services in extension of tramway routes and over the tramway routes, thus bringing long-distance passengers through into the centre of the town. Whatever may be the feeling against this proposal, it is evident that if it is not done by the tramway authority strong attempts will be made to do it by other people.

(3) On any routes which might under normal circumstances have been scheduled as tramway routes. If in certain districts the opinion is held that the whole area is provided for, a re-examination of the question will probably show room for some additional service.

(4) Provision of through services over lengthy tramway routes heavily used for short-distance passengers. This question is likely to be brought forward in a more pronounced manner in the future, and is one in which the question of finance will need careful attention. Is it likely that the long-distance tramway passenger will continue to be satisfied with a service making 20 to 30 stops on his run into and out of town—what interest has he in such wasteful machinery?

(5) Linking up adjacent towns where tramways do not cover the whole length of route. A great traffic is to be picked up on routes of this description despite the fact that there may be a frequent service of trains between the towns. There should be little difficulty in neighbouring municipalities amicably arranging such services.

(6) For meeting night trains and excursions. Cars for each route would result in serious loss, but one 'bus can serve two or three routes with a small number of passengers for each. Good experience has been obtained from the Wembley railway service in regard to this class of traffic, and it has been found that passengers landed at town stations in the early hours of the morning eagerly take advantage of a 'bus service of this description, and are willing to pay a fare sufficient to cover the expenses of operation. Punctuality of such railway services on the part of the companies requires their urgent attention, and the public are beginning to take an interest in the matter.

(7) What might be termed "Health and Recreation Routes." A great work can be done in this direction, and it would undoubtedly be a source of surprise to any committee which has not catered for this class of traffic. It is a good thing to see the people of the industrial areas joining the 'buses for a half-day's outing in the country under healthy and comfortable conditions. Advise them to "make the open country their playground." Experience has shown that by attractive advertising sheets in the cars, and advertising in the Press, calling attention to the motor services and pointing out the attractiveness of the districts served, a great amount of traffic is awaiting us, the difficulty being to meet the demands at the week-ends and at holidays. Sufficient traffic can be obtained at these times to make the service remunerative for the whole year, a minimum service being provided on the quieter days in the week and in winter time.

Tramways alone may have been inclined to get somewhat rusty. Speed them up and with the assistance of motor omnibuses improve them in every way possible. There are clear cases where poor tramway routes have been enormously improved by a service of motor 'buses as feeders. Improve the health of the people in the towns by taking them out into the country.

Brighten the lives of the people in the country districts by giving them the opportunity of visiting the towns whenever they desire to do so. Improve the trade of your district by bringing the people in from the out districts. Protect and supplement your tramways in every possible direction by your own 'bus services. With initiative and enterprise such work can be made intensely interesting. Threatened competition should be resolutely faced and with courage and vision may be rendered unnecessary. These notes are written as the result of the writer's experience of a combined service of tramways and motor omnibuses over a considerable number of years, and with the one desire of benefiting the industry and ensuring the continuance of its successful operation.

Steel-Concrete Poles for Transmission Lines.

The Manufacture and Installation of the "Stobie" Pole.

PROBABLY the principal consideration in providing for an overhead transmission scheme for the supply of electrical energy is the question of the poles for supporting the conductors. The choice of wooden or steel poles has always been a controversial point in many parts of the world where the overhead system of transmission has been adopted to a greater extent than in England, and in view of the growing interest in this country in the question of supplying electrical energy to the rural areas, the consideration of overhead transmission and hence transmission poles will engage the minds of supply engineers at home.

The invention of Mr. J. C. Stobie, a member of the staff of the Adelaide Electric Supply Co., may prove a means of solving many of the difficulties met with in the employment of wooden and all-steel poles. It takes the form of a transmission pole of combined steel and concrete construction, and has been used extensively by Australia by the Adelaide Electric Supply Co., 150 miles of h.p. overhead lines with "Stobie" poles having been constructed. The essential feature in the design of this pole is the use of two light standard rolled-steel joists or channel sections, forming the main outside tension and compression members. These are held at the correct distances apart, tapering from the base to the top, by means of bolts passing through the webs of the sections at carefully determined intervals. The space between the steel sections is filled with concrete, which acts as a continuous web, the embedded bolts taking a portion of the shear stresses. This filling also gives to the completed pole the necessary rigidity and resistance to torsion, which may arise from an unbalanced pull.

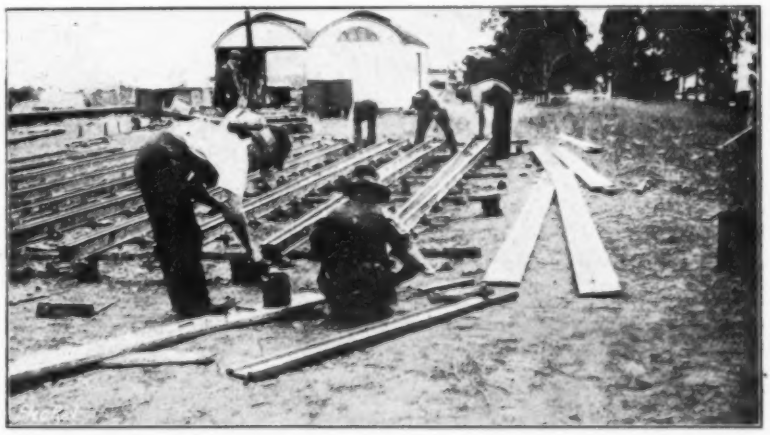


Fig. 1.—Manufacturing "Stobie" Steel-Concrete Poles.

The process of manufacture is a very simple one, call-

ing for neither special machinery nor skilled labour, and has the great advantage of rendering the construction of poles possible near where they are to be installed, as shown in fig. 1. The joists are first laid out on greased steel slides at right angles to their length and fixed with clamps, and a wooden form acting as a spacer is placed between the flanges at the bottom, forming a trough, fig. 2. This is then filled with a stiff-concrete mixture, when another form is placed similarly between the steel members at the top and clamped down. For a few feet at the narrow end of the pole where the joists are close together, the forms are

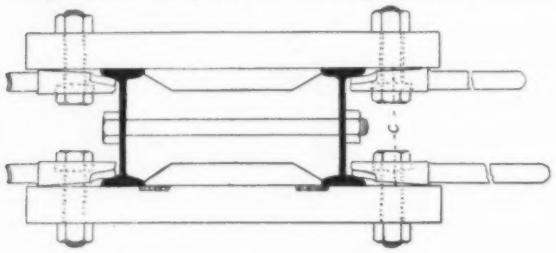


Fig. 2.—Section of "Stobie" Pole and Forms.

not recessed into the concrete, and allow it to run flush with the joist flanges. As soon as the concrete begins to set, the through bolts are tightened up. After 24 hours the forms are removed, and the concrete is allowed to season for from 14 to 21 days. The poles are erected with the cross arms in position; the bolts used for securing the arms to the poles are placed in position before the concrete is set. When completed, the pole has a light and not unsightly appearance. Fig. 3 shows a guyed transposition pole on a cross-country line. Many of the poles manufactured in this way in Australia were

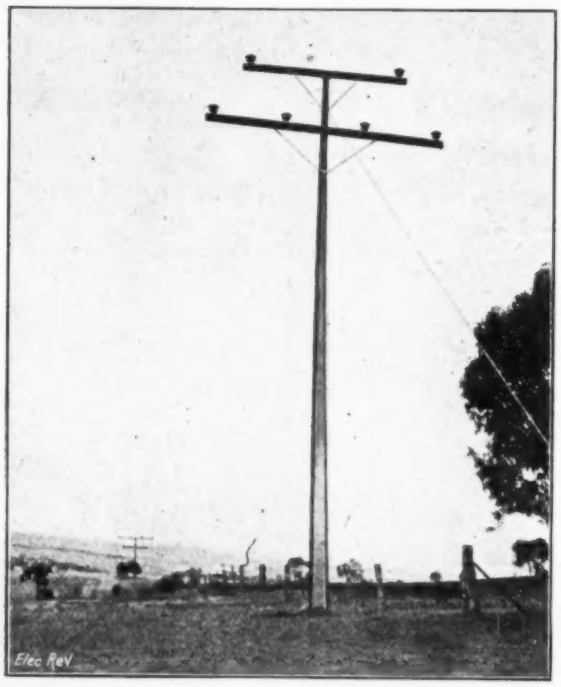


Fig. 3.—A Steel-Concrete Pole in Position.

transported for 20 miles on timber jinkers over rough "bush" tracks, and not a single pole was damaged by the severe handling and jolting it received. The particular claims made for the "Stobie" pole are that by correct section and disposition of the members to withstand the stresses usual in overhead lines, it is for equal strength no heavier than the hard-wood one; while the cost, taking into consideration its longer life, is substantially less than that of wooden poles, and compares favourably with that of fabricated steel structures. Also, as before mentioned, the pole can be made with facility on the site of the transmission line itself.

The "Stobie" pole has been built in 30- to 36-ft. lengths for local low-pressure distribution, and in 42- to 50-ft. lengths for 33,000-V transmission, but the design provides for lengths much in excess of these. A series

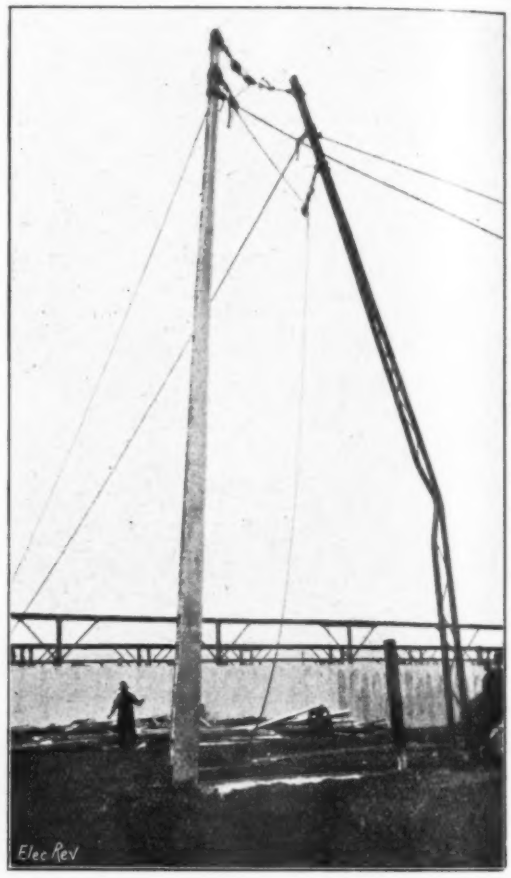


Fig. 4.—Result of Test on a "Stobie" Pole.

of tests have been carried out on poles of this type by an Australian operating company. In one case a steel-concrete pole was tested against

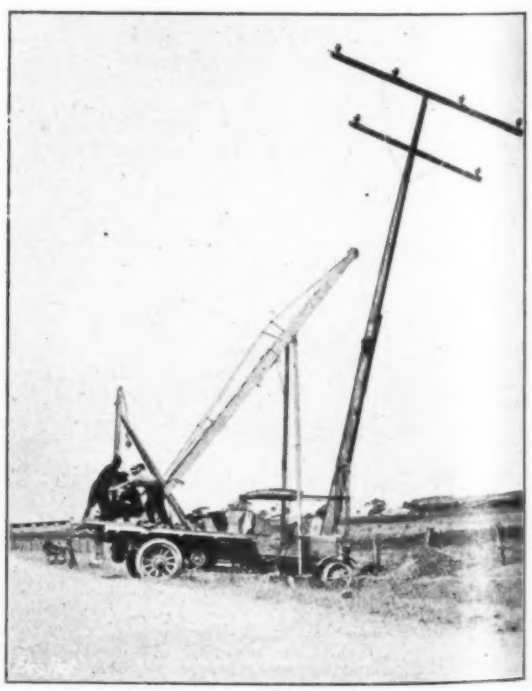


Fig. 5.—The Erection of a 42 ft. 6 in. "Stobie" Pole.

a steel fabricated one, both designed for the same side pull. While both poles showed similar deflections at a 500-lb. pull, the fabricated steel one com-

pletely collapsed at a pull of about 1,300 lb., but the "Stobie" pole only showed a heavy permanent set without fracture (fig. 4). Other tests showed that the "Stobie" pole has a factor of safety of 3 for loads at right angles to the line, and that its strength in the direction of the line is ample for ordinary contingencies. The question of possible corrosion of the steel members at the ground line is receiving careful attention. It is considered that in dry climates, such as that of Australia, little more protection than a coat of paint is necessary. For moister conditions, a coat of bitumastic enamel applied to the base, hot, either with or without the usual weathered concrete footing carried 12 in. above and below the ground, will afford sufficient protection to ensure the pole a very long life.

During erection the poles are easily handled by means of an ordinary jib crane. Fig. 5 shows a 42 ft. 6 in. pole in the course of erection.

We are indebted for the foregoing particulars to Mr. F. W. H. Wheadon, M.I.E.E., chief engineer and manager to the Adelaide Electric Supply Co., who is paying a visit to this country.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

The Bakers' Exhibition.—The 29th annual Confectioners', Bakers', and Allied Trades Exhibition was held at the Agricultural Hall from September 5th to 11th. A marked feature of these exhibitions has been the gradual growth in the use of electrically-driven machinery, and this year's show was notable for a great advance in this respect. It is not possible to enumerate all the firms which displayed this type of machinery; we must be content to mention that the bulk of it comprised dough and cake mixers of various patterns and sizes. Another prominent feature, from our point of view, was the demonstration of electric baking ovens. Three companies showed these—the General Electric Co., Ltd., the Metropolitan-Vickers Electrical Co., Ltd., and the Artofex Engineering Works, Ltd. We hope to give further details of this apparatus in a later issue. The Hobart Manufacturing Co., Ltd., exhibited a great deal of electrically-operated food-preparing equipment, including coffee mills, dough and cake mixers, food cutters and mincers, sausage machines, &c., each with the motor incorporated in the design of the machine. This firm also showed the "Crescent" dishwasher. This machine has a sheet-metal body with a glass front. Two sets of water-jets are employed; one set revolves and performs the washing action while the other set is fixed and is designed to rinse the cleansed plates or dishes. The water-heating arrangement can be electrical, but gas or steam is usually employed. The General Electric Co., Ltd., in addition to the baking oven already mentioned, showed a 4-kW restaurant grill, a doughnut fryer, and a fish-fryer. Autochrome Signs, Ltd., had a display of coloured illuminated signs, with various kinds of flashing and flickering effects, and Mr. E. Duncan Doring exhibited a number of ingenious electro-mechanical advertising devices.

Shannon Scheme Strike.—Labour trouble has occurred at the inception of the Siemens-Schuckert scheme for the harnessing of the River Shannon. It is reported that the contractors endeavoured to make the labourers upon the initial excavation work accept 8d. per hour for a 54-hour week, whereas the union rate for a 47-hour week is 1s. 3d. an hour. The work was delayed for a settlement of the question.

An All-Electric Hire-Purchase Suggestion.—In the September issue of *Electrical Merchandising* it is pointed out that while automobiles and complete bath-room equipments as well as other modern conveniences are sold to the American public by means of "easy-payment" systems, electrical dealers are content to sell a single appliance at a time. At this rate, says our contemporary, complete electrical equipment will never become the standard of the American home. Accordingly the bold suggestion is advanced that the whole of the electrical equipment necessary in a house should be supplied at once on a hire-purchase basis—or against a mortgage. Installations costing from $1,000 to $1,500 are suggested.

"Underfeed" Contracts.—Among the recent orders received from electricity supply authorities by the Underfeed Stoker Co., Ltd., are the following:—Travelling grates: Scottish Central Power Co., Ipswich Corporation, and Gravesend Corporation; ash conveyors: St. Pancras and Hull Corporations; Murray tubes: Glasgow Corporation (Dalmarnock); pulverised fuel plant: Brighton Corporation; "Underfeed" stokers and air heaters: Moghalseria, Gya and Bedawatta power stations; air heaters: Gravesend Corporation; and arches: Eastbourne and Maidstone Corporations.

Reconstruction Work at Paddington.—The Great Western Railway Co. has decided to undertake the reconstruction of Paddington Goods Station and the installation of up-to-date equipment, including electrically-operated labour-saving appliances.—*Financial Times.*

For Sale.—By order of the Receiver, *re* Wakelins Engineering, Ltd., Vicarage Road, Hampton Wick, Messrs. H. Butcher and Co. will sell by auction on the premises on Tuesday, September 22nd, and following day, the lease of the premises, plant, machinery, stores, stock, and goodwill. For full particulars see our advertisement pages to-day.

Trade Commissioners.—Mr. AINSCOUGH, H.M. Senior Trade Commissioner in India, is taking new office premises at Fairlie House, Fairlie Place (P.O. Box 683), Calcutta, from November 1st.

H.M. Trade Commissioner in Western Canada has removed from Winch Building to 18, Commerce Building, Vancouver, B.C.

Free Telegraphic Addresses.—Arrangements have been made by the Postmaster-General, in order to assist foreign trade, enabling any firm with representatives abroad to obtain a telegraphic address for oversea communication free of charge, provided that the applicant is already a holder of one paid registered address. Messages sent "*via* Imperial," by the Anglo-Russian cable, or by the Oxford-Cairo radio service, will be allowed a free registered address without the condition attaching to other routes.

Trade Announcements.—On September 10th, the new show and demonstration rooms in London of Messrs. A. J. STEVENS & Co. (1914), LTD., of Wolverhampton, were opened, the event being marked by a reception and luncheon at which Mr. Lamb presided. The latest models of the company's apparatus were displayed. Mr. Lamb, in the course of a speech, reviewed the development of the business, and said that the staff and workpeople of the company would have passed the one thousand mark before they were many weeks older. He also referred to the wide ground covered by them in manufacturing radio apparatus and accessories. The speaker read a communication received from Sir Oliver Lodge, and other speeches followed. The new premises are situated at 122-124, Charing Cross Road, London, W.C.2.

MESSRS. STUART TURNER, LTD., of Henley-on-Thames, have opened an office at 63, Queen Victoria Street, London, E.C.4, with Mr. B. C. Rhodes in charge, where the Stuart country-house lighting and pumping plants can be seen. 'Phone No.: "City 7381."

INTERNATIONAL COMBUSTION, LTD., has transferred its Commercial Pulverising Department from Africa House to 11, Southampton Row, London, W.C.2.

MESSRS. S. EVANS & SONS, electrical and wireless contractors, have opened premises at 16a and 18, King Street, Maidenhead.

CRYSELCO, LTD., has opened a branch at 35, Duke Street, Brighton, where it will carry stocks of its lamps and all makes of V.M.A. valves. Phone: "Brighton 5512."

Mr. W. H. STONE, agent for South Wales for the Yorkshire Electric Transformer Co., Ltd., and the Wardle Engineering Co., Ltd., who was for many years with Messrs. McWhirter and Sons, Ltd., Cardiff, has removed his office to 63, Rhiwbina, Cardiff.

THE IRON & NICKEL BATTERY CO., LTD., has removed to 17-19, Cockspur Street, Pall Mall, London, S.W.1. Telephone:—"Regent 7187."

Large Canadian Plant Order.—The *Electrical News* (Toronto) states that the Aluminium Company of Canada, which is constructing a large plant at Chute-a-Caron, Quebec, has placed an order for the electrical plant required with the Canadian General Electric Co. The order covers 18 synchronous converters, each of 3,600 kW capacity; 12 transformers of 25,000 kVA each for a primary pressure of 154,000 V; and 10 transformers of 7,500 kVA capacity. The converters will embody automatic starting arrangements.

Catalogues and Lists.—PHILIPS LAMPS, LTD., 60, Wilson Street, Finsbury Square, E.C.2.—An illustrated and priced folder advertising the "Philips" rectifier.

THE CARRINGTON MANUFACTURING CO., LTD., 18-20, Normans Buildings, Central Street, E.C.1.—An illustrated price list of cabinets for radio receiving sets, &c.

MESSRS. FORUM & CO., LTD., 7 & 9, Pershore Street, Birmingham.—Illustrated price lists of radio components and accessories.

MESSRS. A. J. DEW & CO., 33-34, Rathbone Place, Oxford Street, W.1.—Wholesale catalogue for 1925-26 of radio apparatus and accessories of all descriptions. The publication, which has over 200 pages, is fully illustrated and priced.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—September stock list of dynamos and motors.

RADIO INSTRUMENTS, LTD., 12, Hyde Street, New Oxford Street, W.C.1.—A descriptive, illustrated catalogue of radio receiving sets and components; priced. Also a showcard advertising "R.I." apparatus.

MESSRS. I. CALVETE, LTD., 11, Little St. Andrew Street, W.C.2.—An illustrated and priced catalogue of electro-medical apparatus, including violet-ray generators and equipment, hair-waving appliances, &c.

THE METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Leaflets Nos. 783/1-1 and 783/2-1, dealing,

respectively, with the company's arc-welding equipment and its applications.

THE LANCASHIRE DYNAMO & MOTOR CO., LTD., Trafford Park, Manchester.—List No. 445, illustrating and describing the "Crypto" commutating rectifier; and List No. 700, dealing with "Lancashire Maxtorq" induction motors, and describing their manufacture.

MESSRS. T. HARDING CHURTON & CO., LTD., Atlas Works, Water Lane, Leeds.—Circular 660, containing particulars and prices of two- and three-phase induction motors.

WESTERN ELECTRIC CO., LTD., Connaught House, Aldwych, W.C.2.—An illustrated price list of radio receiving sets, components, and accessories.

MESSRS. S. G. LEACH & CO., LTD., 26-30, Artillery Lane, E.C. —An illustrated pamphlet describing "SBIK" automatic oil switches for a.c. motors.

Bankruptcy Proceedings.—JOSEPH BENSON, 18, Ivy Crescent, York Road, Leeds, lately an electrical engineer.—The receiving order in this matter was made recently on debtor's own petition. The statement of affairs shows liabilities of £173, and there are no assets. The first meeting of the creditors was held on August 27th at the Official Receiver's office, Leeds, when the case being a summary one was left with the Official Receiver as trustee. The following are creditors:—

	£		£
Russell, Ltd.	73	Priestman, R.	87

THOMAS BARTON, Ainsworth Street, Blackburn, electrical engineer.—The first meeting of creditors was held recently at the Official Receiver's offices, Preston. The statement of affairs showed liabilities of £3,813, and net assets of £5,794, leaving an estimated surplus of £1,981. Debtor stated that he commenced business at his present address in his own name in 1886 with £600 capital, provided by his wife. He made no profits in the business, but was not aware that he was insolvent. On June 29th last he executed a deed of assignment, and on July 7th a meeting of creditors agreed to accept the deed. The assignment trustee had carried on the business, and paid over to the Official Receiver a sum of £44, being the balance stated to be in his hands at the date of the receiving order. The creditors decided to appoint Mr. A. T. Eaves as trustee.

L. W. PULLMAN, Orchardleigh, Golders Green Road, N.—The first meeting of creditors was held recently at Bankruptcy Buildings, W.C., before Mr. D. Williams, Official Receiver. The debtor, who described himself as an electrical engineer, has carried on business first as a motor-car manufacturer and later as a dealer in wireless goods. According to statements made at his preliminary examination, the debtor in 1921 entered into partnership with three others and they started business as car manufacturers at Richmond under the style of the Globe Manufacturing Company. The debtor put in a capital of £1,250 and retired from the concern, having lost about £2,000. At the end of 1923 he joined the Warren-Lambert Engineering Co., Ltd., at Richmond, it then being in voluntary liquidation. Having a considerable knowledge of radio, gained since 1910, the debtor in January, 1924, obtained a post as wireless salesman and later in the year he joined the Radio Supplies, Ltd., which went into voluntary liquidation the same year. Since March last he has bought and sold radio goods for cash on his own account. No statement of affairs was lodged, but the debtor roughly estimates his liabilities at £1,490 and returns in the shape of assets, doubtful book debts of the face value of £639. He attributes his position to loss incurred in the Globe Manufacturing Co., failure to obtain substantial employment, and inability to perfect his various inventions. The estate was left in the hands of the Official Receiver.

ARTHUR KITSON, electrical engineer, &c., 1, Central Hall Buildings, S.W.1.—A receiving order was made against this debtor at the London Bankruptcy Court on August 26th upon the petition of creditors and on September 14th the first meeting of creditors was held before Mr. Wheeler, Assistant Official Receiver. Having dealt with the proofs of debt the chairman reported that it appeared from the debtor's statements in his preliminary examination that he went to America in 1879 and obtained employment with various electrical firms. He started on his own account as the Kitson Lighting Company, which business was afterwards formed into a limited company with offices in Philadelphia. The debtor acted as president and managing director of the concern until it was merged into the United Lighting & Heating Co.; he sold his interest in the company in 1899 and in the following year came to England with considerable capital invested in American securities. He next formed Kitson's Lighting Co. of Great Britain, but withdrew from that business after a year or so in order to work certain patents for lighting which he had in hand. In 1902 he started the Kitson Light Foreign Supply Company with works and offices at Willesden, and five years later converted that undertaking into the Kitson Empire Light Co., Ltd., which company went into voluntary liquidation in 1910. Assisted by certain friends the debtor purchased the assets from the liquidator and the company was revived and carried on under the same name until 1922, when the title was changed to the Kitson Engineering Co. (London), Ltd., with offices and works at Stamford. A receiver for the debenture holders was appointed recently. The debtor acted as chairman and managing director for some years, but had received no remuneration for two years past, and in consequence got into debt, apart from personal liability upon guarantees given on behalf of the company. He had stated that he saw a good prospect of raising funds with which to discharge the receiver, in which event his holding in the company would again become valuable. No statement of affairs had been lodged but the debtor roughly estimated his liabilities at £15,000 and he had in the shape of assets various shares to the nominal amount of £20,000, but having no present marketable value, and a sum of £1,000 due from the Kitson Engineering Co. He attributed his failure to the company's inability to pay the moneys owing to him. In the absence of a quorum the meeting was adjourned for a week.

S. SCARFI (Scarfi Bros.), cycle, gramophone and wireless agent.—Last day for proofs for dividend, September 30th. Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.

C. W. A. ASHWORTH, electrical engineer, West Street, Oundle, Northampton.—Last day for proofs for dividend, September 26th. Trustee, Mr. J. L. Poland, Official Receiver, 5, Petty Cury, Cambridge.

J. KINGSTON (Cromwell Engineering Works), electrical and general engineer, 176, Romsey Road, Shirley, Southampton.—Last day for proofs for dividend, September 23rd. Trustee, Mr. C. Hoult, Official Receiver, Midland Bank Chambers, High Street, Southampton.

W. T. ROBINSON and H. ATTERBY (J. T. Beckett & Co.), electrical engineers, 134, Victoria Street, Grimsby.—First and final dividend of 8s. 5d. in the £, payable at 1, Town Hall Street, Grimsby.

F. J. NORTH, electrical engineer, 13a, Midland Road, Wellingborough.—Last day for proofs for dividend, September 25th. Trustee, Mr. D. Helliar, Official Receiver, The Parade, Northampton.

J. E. LOCKING, dealer in cycles and wireless goods, 14, Fish Street, Kingston-upon-Hull.—First and final dividend of 2s. in the £ payable at the Official Receiver's office, 37, Scale Lane, Hull.

V. G. BAINES, electrician, 2, West Street, Wellingborough.—First and final dividend of 4s. in the £ payable at the Official Receiver's office, The Parade, Northampton.

Company Liquidations.—CARTER & MITCHELL, LTD., wholesale electrical suppliers, 24, Allsop Street, Upper Baker Street, N.W.1.—A meeting of creditors was held at the above address on September 8th, when the liquidator, Mr. J. V. Higson, of Bradford, reported that the liabilities amounted to £1,237, while the assets, after allowing £61 for preferential claims, totalled £407, leaving a deficiency of £830. The company was formed in July, 1923, with a nominal capital of £2,000, of which £1,000 had been issued. The accounts to June 30th, 1924, showed sales of £3,378, with a gross profit of £577, and a net loss of £802. During the 14 months to the date of liquidation, sales had been £3,507, with a gross profit of £686, and a net loss of £587. After some discussion, Mr. Higson intimated his willingness to resign his position as liquidator, and to request the shareholders to pass another resolution appointing Mr. Charles Latham, 78, New Oxford Street, W.C., as joint liquidator with himself, to obviate the expense of going to the Court. A resolution to that effect was carried. The following are creditors:—

	£		£
Davis, Kent & Stewart	24	Hogan & Wardrop	76
Stewarts, Ltd.	62	Mitchell, T.	376
Planet Stamping Co.	24	Welsbach Lighting Co.	169
Lighting, Heating & Glass, Ltd.	271	Wettern Bros.	51

JOHN R. KINSEY & CO., LTD., Croydon.—The winding-up order herein was made on a creditor's petition. The statement of affairs showed gross liabilities of £4,691, of which £3,422 was expected to rank, against assets of £1,824, from which had to be deducted preferential creditors £350 and loans on debenture bonds £919, leaving net assets of £556, or a deficiency of £2,866. The issued share capital of the company is £3,636, and there is a total deficiency as regards the shareholders of £6,502. The failure of the company is attributed by the directors to losses arising out of a transport service; heavy working expenses; and a judgment and damages obtained against the company. The company was incorporated in January, 1922, to take over the business of motor repairers and electrical engineers previously carried on by the promoters in partnership at Croydon. In the terms of the agreement the company agreed to purchase the assets, including the goodwill, of the business, the consideration for the purchase being £2,686, satisfied as to (*a*) £1,518 by the allotment of fully-paid shares, and (*b*) £1,168, by the due discharge by December, 1922, of the partnership liabilities as existing on August 31st, 1921. There was no professional valuation made, but the purchase consideration, £2,685, is stated to have been based upon the book value of the net assets, the goodwill being taken at £300. Mr. Kinsey stated that the company soon after its incorporation in January, 1922, commenced to develop, on a larger scale than previously, its film transport service, working it as a separate section. Owing, however, to the heavy working expenses and bad debts incurred, this section was not successful and was closed down. As a result the electrical and automobile sides of the business were seriously handicapped and losses in working them also were made throughout. In April, 1924, the company, requiring further working capital, raised £200 by the issue of debentures. In October, 1924, judgment for £600 with taxed costs (£250) was obtained against the company by the petitioning creditor as damages for personal injuries received by him from one of the company's vans. The company's own legal charges amounted to £200, and being unable to satisfy these and another similar judgment for £129, voluntary liquidation was commenced on November 19th, 1924, and on November 20th, 1924, the liquidator was also appointed by Court as receiver and manager for the debenture holder, and thereupon entered into possession of the assets. The receiver for the debenture holder stated that he had realised practi-

cally the whole of the company's assets, but it was doubtful whether the proceeds, after payment of the outgoings, would be sufficient to satisfy the debenture holder.

NORTHUMBERLAND AND DURHAM RADIO ENGINEERING CO., LTD., Newcastle-on-Tyne.—A meeting of the creditors of the above was held recently, when the chair was occupied by the liquidator of the company, Mr. John Mitchell. The latter explained that he was unable to prepare a deficiency account owing to the state of the company's books, but an approximate statement of affairs disclosed liabilities of £204, all due to unsecured creditors. The net assets were estimated at £84, leaving a deficiency of £120. The company was formed in February of this year with a nominal capital of £1,000, and the total issued capital was £275. The matter remains in the hands of the present liquidator.

J. SPRINGER, LTD., 158, Wardour Street, W., kinema furnishers and electrical engineers.—At a recent meeting of creditors, Mr. C. B. Holland, the liquidator in the voluntary liquidation, presented a statement showing a deficiency as regarded the creditors of £110,750. An advisory committee was appointed to assist the liquidator. The following firms appear in the list of creditors:—

	£		£
Albany Engineering Co.	29	S. G. Leach & Co., Ltd.	34
British Thomson-Houston Co., Ltd.	32	Mickelwright, Ltd.	78
Condor Lamps, Ltd.	81	Manufacturing Engineers, Ltd. ...	36
Hendon Electric Lamp Co. ...	36	North British Rubber Co., Ltd.	494
K. F. M. Engineering Co., Ltd.	72	Sloan Electrical Co.	53
R. A. Lister & Co., Ltd. ...	45	Wilkins & Wright	22

CONTINUOUS REACTION CO., LTD.—Winding up voluntarily. Liquidator, Mr. E. C. G. Clarke, Nobel House, Buckingham Gate, S.W. A meeting of creditors was called for September 15th, at Nobel House.

STEARN ELECTRIC LAMP CO., LTD.—A meeting of members is called for October 12th, at 12, Grosvenor Gardens, S.W., to hear an account of the winding up from the liquidator. The business was sold to the Stearn Electric Co., Ltd., a new company, a year ago.

ELECTRICAL ENGINEERING (WEST BROMWICH), LTD.—A meeting of members is called for October 12th at 5, Waterloo Street, Birmingham, to hear an account of the winding up from the liquidator, Mr. J. D. Kerr.

Private Arrangements.—S. E. BLAND, trading as S. E. BLAND & CO., Queen Street, Cheapside, E.C., electrical engineer.—The creditors interested herein were called together on September 9th, at the offices of Mr. P. S. Booth, Holborn Viaduct, E.C. The statement of affairs showed ranking liabilities of £1,487 and net assets of £641, leaving a deficiency of £846. The deficiency was more than accounted for by the depreciation written off the assets, whilst law costs of £25 had been incurred. Mr. Booth reported that the debtor was previously an estimating clerk with an electrical company. In February, 1923, he started trading on his own account. He had a capital of £70, and borrowed £500 from his father. During the first year there was a net profit of £79. Last September he acquired a five-years' lease of another shop in Queen Street. During the year to February last there was a net profit of £168. The drawings in the first year were only £61, and in the second year they were £112. Since February last the turnover had been £2,500. Three assistants were employed who received salaries and commission. The debtor had suffered through lack of capital. Recently an execution was levied and as other creditors were pressing a deed of assignment was executed, the trustees being Mr. Booth and Mr. C. Latham, of 78, New Oxford Street, London, W. The debtor's father would like his son to continue the business, and it was possible that an offer would be submitted. It was decided to confirm the deed already executed, whilst a committee of three of the principal creditors was also appointed. The following are creditors:—

	£		£
Barclay's Advertising Co., Ltd. ...	31	Lee, Albert, & Co. (1923), Ltd.	60
Chloride Electrical Storage Co., Ltd.	28	De Leew & Co., Ltd.	37
Duke & Nedermeyer	36	Merchants & Agencies, Ltd. ...	30
Dickeson, C. R., & Son, Ltd. ...	42	Manhattan Electrical Supplies Co. (New York)	203
Electrical Manufacturing & Plating Co.	40	Stella Lights, Ltd.	20
Houghtons Ltd.	22	Siemens & English Electric Lamp Co., Ltd.	73
Ironmonger	24	Siemens Bros. & Co., Ltd. ...	61
London Electric Wire Co. and Smiths, Ltd.	20		

New French Company.—A new company has lately been formed in Paris (134, Avenue Malakoff), with a capital of 800,000 fr. and the title La Société pour la Fabrication des Projecteurs Electriques Marchal, to manufacture headlights for motor vehicles in accordance with the Marchal patents.

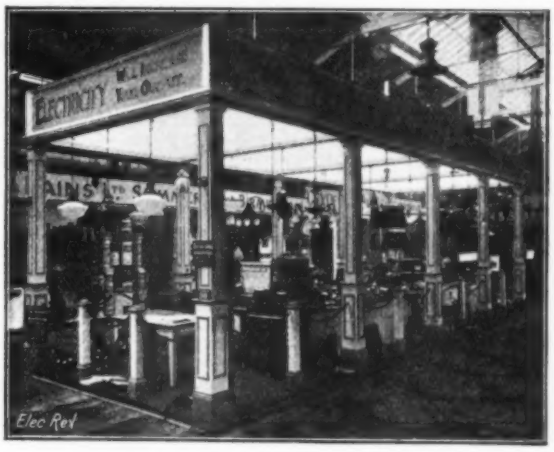
New Italian Companies.—Among the lighting and power undertakings recently formed in Italy are the Società Impresi Elettriche Sicule-Lombarde, Milan, with a capital of 100,000 lire, to take over the undertaking previously known as the Società Imprese Elettriche Nuvolari Angelini; the Società Elettrica Salentina, Bari, 100,000 lire; the Società Elettrica Latronichese, Latronico (Lagonegro), 200,000 lire; the Società per la Produzione Elettrica, Polizzi Generosa, 360,500 lire; and the Società per le Imprese Elettriche del Gizio, Rome, 100,000 lire.

Italian Loan in the United States.—The Milan correspondent of the *Financial Times* reports that the Cia. Electrica Edison has been successful in its negotiations for placing a $9,000,000 debenture issue in New York.

Dissolution of Partnership.—AMOS & COLEMAN, electrical and motor engineers, 25, Thomas Street, Liverpool.—Mr. E. Amos, Mr. E. C. Wright, and Mr. S. R. Coleman have dissolved partnership. Messrs. Amos and Wright will attend to debts.

The A.E.G. in Argentina.—The *Review of the River Plate* records the formation of the A.E.G. Cia. Argentina de Electricidad, with a capital of $2,000,000 m/n, to take over the assets and liabilities of the A.E.G. Cia. Sudamericana de Electricidad, established in Buenos Aires for the "importation, buying and selling of merchandise, electrical machinery and installations."

Electricity at the Birmingham Building Exhibition.—The Building and Allied Trades Exhibition at Bingley Hall, Birmingham, which was opened on September 7th, by Sir H. Kingsley Wood, M.P., Parliamentary Secretary to the Ministry of Health, and closes to-morrow (Saturday), has been well attended by representatives of trade organisations, and particularly by those associated with local housing and road construction schemes. The exhibition, which was organised by the Birmingham Chamber of Commerce, covers practically the whole field of building work and material, and the internal equipment of houses, prominence being given to electricity in the home. The Birmingham Corporation Electric Supply Department has a stand which in its character is extremely comprehensive. This stand, which is illustrated in the accompanying figure, includes an attractive selection of modern lighting fittings and electrical apparatus, to show the comfort and convenience gained by the installation of electricity for lighting, cooking, heating and other domestic purposes. In addition to the cookers which are being demonstrated, a number



The Birmingham Corporation's Stand at the Building Exhibition.

of electric grills, toasters, coffee percolaters and kettles, are shown. There is also a wide variety of electric fires and heating apparatus; a dish washer; an electric wash boiler; and a clothes washer. Another useful article on view is a small domestic type motor, which can be used to drive a grinder to sharpen knives, and a buffer to polish silver and plate, to drive a small fan, or to work a sewing machine. A few drills and other small portable electric tools are also exhibited. Lectures have been given dealing with such subjects as lighting, heating, and cooking, and also on the use of electricity in the home. Mr. W. E. Bush, of the E.L.M.A. Lighting Service Bureau, and Mr. J. W. Beauchamp, of the Electrical Development Association, were jointly responsible for an interesting contribution. Mr. Bush declared that more progress had been made in the last 14 years in the development of artificial light sources than was made in the preceding 2,000 years. The greater use of electric power in industry was urged by Mr. Beauchamp. Discussing the subject of lighting in industry, Mr. W. J. Jones, of the Electric Lamp Manufacturers' Association, declared that the advent of artificial light had contributed considerably to the stability of industry.

Stoker Contracts.—Riley stokers, constructed by the Riley Stoker Co., Ltd., have been exclusively adopted by the Union Cold Storage Co., Ltd., for its new power plant. Each boiler has a single stoker, direct driven by an electric motor, and provided with its individual fan. The Luton Corporation has placed a further repeat order with the company for Riley stokers to replace stokers of another type, and six more large Riley stokers have been ordered for the latest extension of the Buenos Aires central power station.

Unemployment.—During the week ended August 31st, for the fifth successive week, there was a serious rise in the number of registered unemployed, the total at that date being 1,354,100. This was 10,362 more than a week earlier and 191,220 more than at September 1st, 1924.

Battery Vehicle Aids Hospital.—A lorry belonging to the D.P. Battery Co., Ltd., fitted with "Kathanode" batteries, obtained first prize in a carnival organised in aid of the Bakewell War Memorial Cottage Hospital. It was arranged as a "mobile fair" and collected over £18 for the hospital funds.

Our Foreign Trade.—AUGUST FIGURES.—The Board of Trade returns for August show the following values of electrical imports and exports :—

	August, 1924.	Inc. or dec.	8 months, 1925.
Imports.—	£	£	£
Electrical goods and apparatus	324,272	+ 80,733	+ 808,299
Machinery	1,002,104	+163,252	+1,131,408
(Electrical machinery)	106,132	+ 25,094	+ 37,240
Exports.—			
Electrical goods and apparatus	777,764	− 33,452	+1,423,531
Machinery	4,165,375	+700,996	+3,502,793
(Electrical machinery)	488,406	+111,324	+ 604,005
Re-exports.—			
Electrical goods and apparatus	10,866	+ 672	+ 64,394
Machinery	170,398	+ 87,579	+ 227,120
(Electrical machinery)	4,203	− 1,138	− 21,697

Book Notices.—"Mechanical Draught for Boilers" (48 pp.; 32 figs.). Belfast: Davidson & Co., Ltd.—Although this publication is described as "Catalogue No. 18," it is more of a treatise than mere "publicity matter." The advantages of mechanical over natural boiler draught are considered, and particulars follow of the various forms of mechanical draught. Naturally the firm's "Sirocco" apparatus is given prominence, but this does not detract from the general usefulness of the publication.

"Talks About Wireless," by Sir Oliver Lodge. Pp. viii+251. London: Cassell & Co., Ltd. Price 5s. net.

"Scientific Paradoxes and Problems," by A. S. E. Ackermann, B.Sc., A.M.Inst.C.E. Pp. viii+131. London: Old Westminster Press. Price 5s. net.

"British Wire-Drawing and Wire-Working Machinery," by H. Dunell. Pp. xv+188; figs. 181. London: Constable and Co., Ltd. Price 21s. net.

"Scientific Papers of the U.S.A. Bureau of Standards."—No. 503, "A Flow Calorimeter for Specific Heats of Gases." (20 cents.)

Meter Approved.—The Electricity Commissioners have approved of the construction and pattern of, also the means provided for fixing and connecting the meter known as the Ferranti single-phase watt-hour meter, Type F.C.b., rated from and including 2.5 amp. to 20 amp., 100 V to 500 V, at a frequency of 50 cycles per second.

British Trade Mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from September 9th, 1925. In the case of foreign applications, the names and addresses of the British representatives are also given :—

Dubritte. No. 458,941. Class 6. Mechanical and electrical advertising signs.—Dorothy J. Davis, 1, Park Mansions, St. Paul's Avenue, N.W.2.

Accurect. No. 455,678. Class 8. Rectifiers for charging automobile batteries and discharge tubes for X-ray purposes.—Philips' Gloeilampenfabrieken, Eindhoven, Holland. (Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.)

Wates Bros., Kingsway (lettering and design). No. 455,776. Electrical apparatus included in Class 8.—Wates Bros., Ltd., 12-14, Great Queen Street, W.C.2.

Uniplex. No. 458,405. Class 8. Amplifiers for use in radio telegraphy and telephony.—Burndept Wireless, Ltd.

Holcos (lettering and design). No. 458,492. Class 8. Sound wave detectors for use in radio-telephony.—Holmes, Wilson & Co., Bolton Road, Pendleton, Manchester.

Atlas. No. 456,676. Class 8. Electric batteries (not for medical purposes).—O. Ruhl (1922), Ltd., 85, City Road, E.C.2.

Plastographe. No. 459,271. All goods in Class 8.—Rignon, 1, Rue Blanche, Paris. (Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Kay Ray (lettering and design). No. 460,285. Class 8. Instruments and apparatus for use in radio telegraphy and telephony and parts thereof.—Kate Raymond, trading as K. Raymond, 1, Grape Street, W.C.2.

Triotron (lettering and design). No. 460,449. Class 8. Valves, instruments, and apparatus for use in radio telegraphy and telephony.—Roysentul, 36, Camomile Street, E.C.2.

Andia. No. 460,832. Class 8. Radio telephone apparatus, &c.—Andia, Ltd., Sentinel House, Southampton Row, W.C.2.

Jedson. No. 460,830. All goods in Class 8.—John E. Dallas & Sons, Ltd., 8 and 10, Betterton Street, Drury Lane, W.C.2.

Maxtrip. No. 460,144. Class 13. Incandescent electric lamps (ordinary).—British Electric Lamps, Ltd., 13a, Tabor Grove, Wimbledon, S.E.19.

Nitraglas. No. 459,857. Class 14. Globes and shades used for illuminating purposes.—General Electric Co., Ltd.

Kalioko. No. 457,109. Class 40. India-rubber prepared in strip form for electrical insulating purposes.—Callender's Cable & Construction Co., Ltd.

Local Exhibitions.—SALFORD.—The Electricity Committee is holding an exhibition of electrical appliances at the Pendleton Town Hall, to commence on September 21st. An electric-cooker hiring scheme is to be instituted on October 1st.

SALE.—Alderman W. T. Dagnall, the chairman of the Manchester Corporation Electricity Committee, recently opened a comprehensive exhibition of electrical appliances at the Sale Town Hall. The exhibition marked the introduction of the Norwich system of charging for electricity. Leading apparatus manufacturers in the country demonstrated their washing, cooking, and other domestic apparatus.

LIVERPOOL.—A radio exhibition opens at Liverpool to-day for a period of nine days. Every phase of wireless progress is to be represented, and many Liverpool radio firms have taken stands, as well as firms from London and other important centres. Demonstrations of the building of sets are to be given by the Liverpool Wireless Society and by Mr. J. E. Kemp (chairman of the Manchester and District Association of Radio Societies). The components for these sets are presented by exhibitors and at the close of the exhibition the sets will be sold in aid of a local charity. There are two competitions, the first is for the best two-valve amplifier, for which 30 guineas is offered in prizes, and the other for a portable one-valve set, total prizes 25 guineas.

BERMONDSEY.—An electrical exhibition, under the auspices of the borough electricity department, was inaugurated by the Mayor on September 14th. The Corporation stand was divided into two sections—a sitting room and a kitchen—and was wired and fitted for lighting, cooking, heating, &c. Other stands were occupied by leading electrical firms exhibiting domestic electrical apparatus. These included the Cable Accessories Co., Ltd., Credenda Conduits, Ltd., the General Electric Co., the Hotpoint Co., Ltd., Holophane, Ltd., the Jackson Electric Stove Co., Ltd., Metro-Vick Supplies, Ltd., and the Wholesale Fittings Co., Ltd. Electrical apparatus was also loaned for the occasion by the London Electrical Co., Messrs. Siemens Bros. & Co., Ltd., and the Edison Swan Electric Co., Ltd. The City Electrical Co., Ltd., exhibited electrically-driven machines, and Messrs. Barton & Gillette showed an electrical horse-clipper. A finishing machine used for boot repairing was demonstrated by Messrs. Keats & Bexon, and the Hobart Manufacturing Co.'s exhibits included a cake-mixer and a sausage-making machine. The chairman of the Electricity Committee announced that the charge for lighting was to be reduced from 6½d. to 5½d. per kWh.

Electricity at a Horticultural Show.—One of the attractions of the recent annual show of the Royal West Renfrewshire Horticultural Society was a stand arranged by the Greenock Corporation Electricity Department (engineer and manager, Mr. F. H. Whysall). As will be seen from the illustration herewith, the display had a floral background and was arranged as a tea table with appropriate lighting standards and small appliances. Four types of fire and a "Creda" cooker represented the larger domestic appliances. The Department secured an award of merit for this stand.

Electricity at the Greenock Horticultural Show.

Irish Free State Electrical Imports.—The Irish Free State Ministry of Industry and Commerce has now issued detailed figures of imports for the first quarter of 1925 as compared with the corresponding period of last year. From these we have compiled the appended table showing the value of the total imports of electrical machinery and apparatus into the Free State and the amount attributed to the United Kingdom as ports of consignment but not necessarily as the country of manufacture.

	Total.		U.K. Share.	
	January to March.		January to March.	
	1925.	1924.	1925.	1924.
	£	£	£	£
Electric wires and cables	21,935	14,077	15,873	12,128
Teleg. and telegraph instruments and apparatus	5,832	10,511	5,791	10,407
Electric lamps and parts	12,569	8,352	12,364	7,572
Batteries and accumulators	6,879	3,578	6,631	3,160
Radio sets and parts ...	14,483	29,637	13,988	29,589
Other elec. goods and apparatus	11,706	34,738	11,034	33,182
Electric generators ...	4,438	2,189	4,504	2,145
Electric motors	8,488	5,476	8,453	5,371
Other electrical machinery	27,337	9,476	26,447	9,399
Total ...	£113,667	£118,034	£105,085	£112,953

It will be seen that while wide variations are shown in the different classes of goods, the 1925 imports are within £4,500 of those of last year. All but £8,582 of the goods came from the United Kingdom, and of the balance £5,719 is attributed to Belgium, £1,683 to Germany, and £1,180 to other countries.

New Indian Companies.—The Battery Service Co. is the name of a new concern which has lately been formed at 5, New Queens Road, Bombay, with a capital of 25,000 rupees, to deal in batteries for motor vehicles.

STEWART JACKS, LTD., has recently been formed in Bombay (Wodehouse Road), with a capital of 1,00,000 rupees, to carry on business as electrical engineers.

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Electricity Supply in Nottingham and District.

The New North Wilford Power Station.

THE official opening of the North Wilford power station by Mr. Alderman Edmund Huntsman, the chairman of the Nottingham Electricity Committee, yesterday, marks an important epoch in the history of electricity supply in the City of Nottingham and the surrounding district.

The first public supply of electricity within the City was provided by the Corporation in 1894, under the powers of an Order granted in 1890; by the Nottingham Corporation Act, 1923, the area of supply was extended to its present dimensions.

Up to the present time the supply has been generated at four stations, one at Talbot Street, established in 1894; one at St. Ann's Well Road, established in 1902; the refuse destructor station at Eastcroft Depôt, established in 1902; and the North Wilford temporary station, established in 1922. With the exception of four 3-phase, 6,600-V turbo-alternators, two at St. Ann's Well Road, and two at the temporary North Wilford station, the whole of the generating plant consisted of Willans non-condensing engines and Siemens d.c. dynamos working at about 400 V pressure. The total plant capacity, before certain of the Willans-Siemens machines were recently removed, was 17,730 kW.

The Corporation had been aware for a long time that its existing generating plant was out of date and uneconomical, and in December, 1918, a conference of local authorities instructed Mr. J. H. Rider, M.I.E.E. (of the firm of Preece, Cardew & Rider, consulting engineers) and the late Mr. C. H. Wordingham "To consider and report fully upon the question of the supply of electricity in the district and to advise as to the course which should be followed by the municipalities." These gentlemen presented a report in August, 1919, the chief recommendations of which were the erection of the first section of a large power station on the Trent, at Long Eaton, a system of primary transmission mains between Long Eaton and the principal towns in the district, and a system of secondary transmission mains radiating over the whole district. The Electricity (Supply) Act, 1919, seriously curtailed the financial possibilities, and led to a modified scheme being proposed.

Fig. 1.—Exterior View of Station.

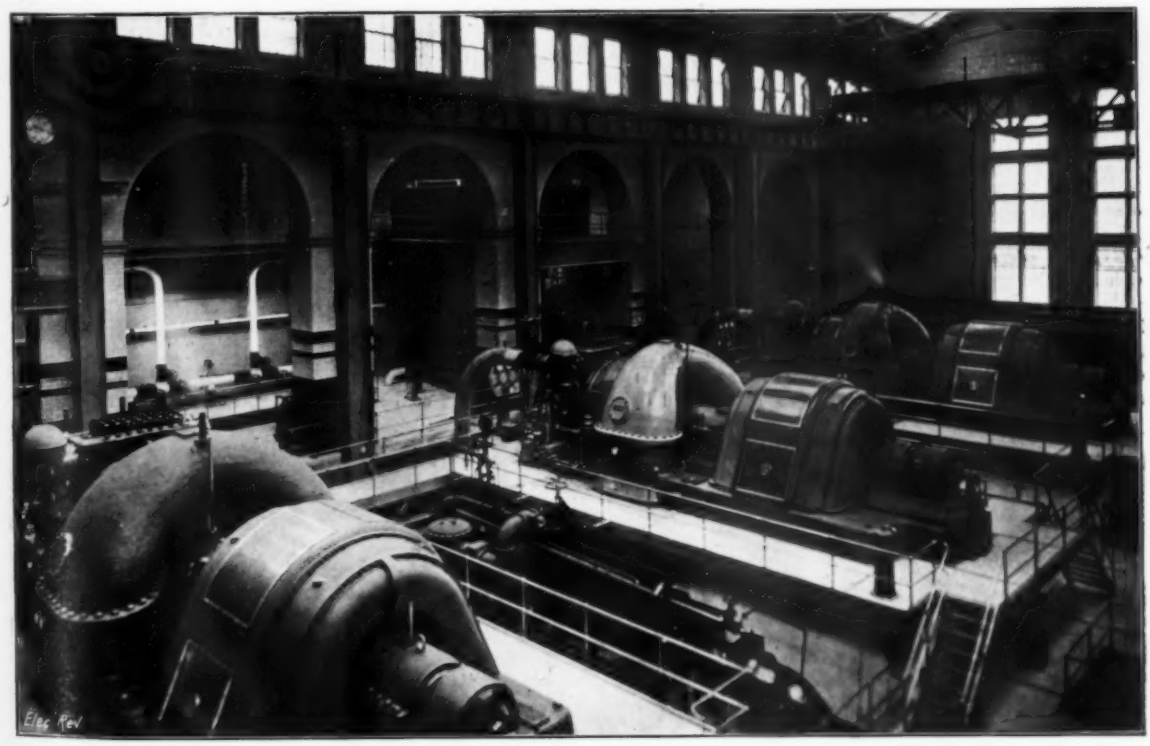

Fig. 2.—Interior of Turbine Room.

In December, 1919, Mr. Rider was retained by the Nottingham Corporation as its consulting engineer and instructed to report as to a site in the neighbourhood of the city suitable for the erection of a new power station. After a careful investigation he advised the acquisition of the North Wilford site, and an application was forthwith made to the Electricity Commissioners for permission to build a generating station on it. This was granted in September, 1920.

Fig. 3.—Induced-Draught Fans.

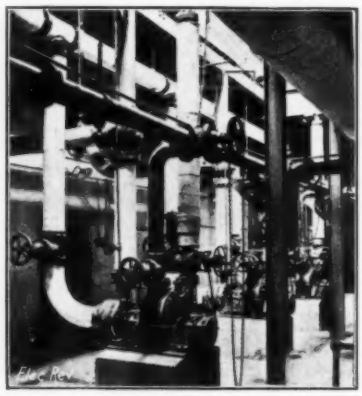

Fig. 4.—Boiler Feed Pumps.

The site at North Wilford, almost an ideal one for a large power station, extends from the River Trent to the L.M. and S. Railway, and adjoins the Clifton Colliery. It has an area of about 80 acres, and sandstone rock is found at a depth of about 15 ft. below the surface. Water for condensing purposes is available for a load of about 200,000 kW.

The general layout of the station is such that the turbine room, with the condensing plant and the switchgear, lies parallel to the river, and will be extended in the same direction. The boiler house is at right angles to the turbine room, and additional boiler houses will be erected as the turbine room is extended. A separate external coal silo, holding about 5,000 tons, has been provided for each boiler-house section, and the various silos will be supplied from a row of receiving hoppers, with two lines of railway tracks. There are four receiving hoppers for each boiler-house section, and each hopper holds about 40 tons. As the line of hoppers is extended with additions to the plant, longer trains will be accommodated. Crushing plant, fig. 7, is provided below the receiving hoppers, and the crushed coal is conveyed by duplicated gravity bucket conveyors to the external silos. Each line of conveyors will carry 40 tons per hour. A similiar duplicate line of conveyors, fig. 6, takes the coal from chutes below each silo to the service bunkers over the centre of the boiler house. One bunker, holding about 140 tons, is provided for each pair of boilers, and each bunker is divided into three compartments.

The boiler house, which is 150 ft. long and 85 ft. wide, is designed for two rows of four boilers, with a central firing gangway. Six boilers are at present installed; each has a normal evaporation of 55,000 lb. per hour at a pressure of 250 lb. per sq. in., and a superheat temperature of about 650 deg. F. Each boiler is provided with three mechanical stokers of the chain-grate type, and a coal meter is fitted to each grate. The ashes are received in hoppers at the backs of the grates, and fall directly, through sealed chutes, into a water trough conveyor for each line of boilers. The conveyors lift the

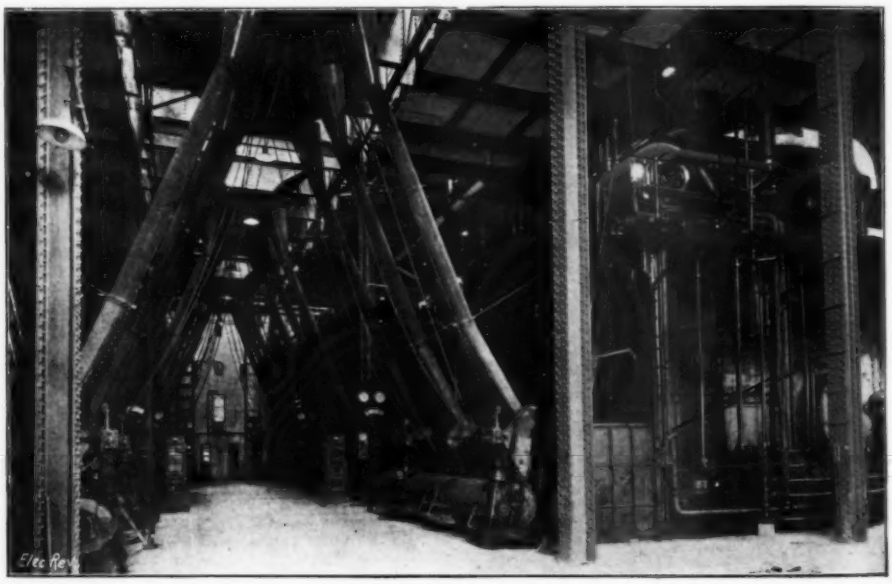

Fig. 5.—Interior of Boiler House.

Fig. 6.—Coal Conveyor.

Fig. 7.—Coal Crusher.

ashes to external silos, from which they can be removed in carts, tubs, or railway wagons. For many years to come the ashes will be deposited over the low-lying land behind the power station, until this has been brought up to the final site level. The gases from each boiler pass up, through a short vertical flue, to a fuel economiser on a gallery floor above, and thence to a steel chimney, 9 ft. in diameter and 96 ft. above the ground level. One chimney is provided for each pair of boilers. The boiler furnaces are worked on the balanced draught system, with atmospheric pressure above the fires. A separate forced-draught fan in the basement delivers the air under pressure below the grates of each boiler, and a separate induced-draught fan, fig. 3, between the economiser and the chimney, draws the gases from the combustion chamber and discharges them up the chimney. The fans for each boiler are controlled from the firing floor. A complete system of dust- and soot-removing plant has been provided. Steam jet blowers are used for the boiler and economiser tubes, and a vacuum pump removes the flue dust and soot to a container in the yard, whence it is readily taken away.

The boiler feed-water plant is located in an annexe between the turbine room and the end of the boiler house. Three turbine-driven feed pumps, fig. 4, have been installed in the basement, each capable of dealing with 250,000 lb. of water per hour, against the full boiler pressure. Duplicate feed pipes run down each side of the boiler house, with connections to the various economisers and boilers.

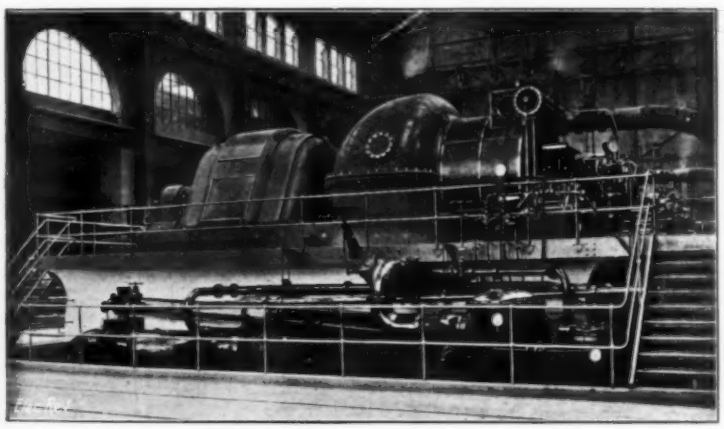

Fig. 8.—One of the Main Turbo-generators.

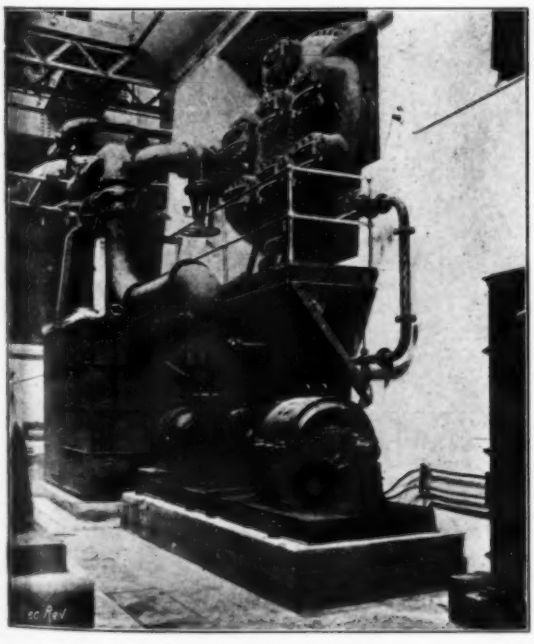

Fig. 9.—Condensing Plant.

Fig. 10.—Circulating Pumps.

The exhaust steam from the boiler feed pumps is led to closed hotwell tanks, where it passes through exhaust heaters. The overflow pipes from these and the closed storage tanks are sealed in subsidiary tanks, the overflow from which goes to the drainage system. The boilers and economisers are emptied or blown down into a large steel tank, with an 18-in. atmospheric pipe to relieve all pressure. The blowdown tank is drained to a sump pit and thence to the river, *via* the discharge tunnel of the condensing-water system.

The turbine room, at present 112 ft. long and 75 ft. wide, exclusive of a railway bay and space for unloading 50 ft. long, contains three 12,500-kVA, 1,500-r.p.m. turbo-alternators, mounted on monolithic concrete foundations, and one auxiliary 1,000-kW turbo-alternator-dynamo. The last-named set is geared, the turbine running at 3,000 r.p.m., and the alternator and direct-current generator at 750 r.p.m. The three main alternators generate 3-phase energy at 11,000 V between phases, and 50 cycles per second. The 200-kW auxiliary 3-phase alternator generates at 420 V, and the 800-kW generator at 490 V. Separate surface condensers are provided for each turbine, with duplicate air and condensate pumps for the 12,500-kVA machines. One of the former in each case is of the hydraulic type, and the other of the steam ejector type. The condensing plant is designed for a vacuum of 29 in. with the barometer at 30 in. The feed-water heaters are fed with steam bled from the high- and

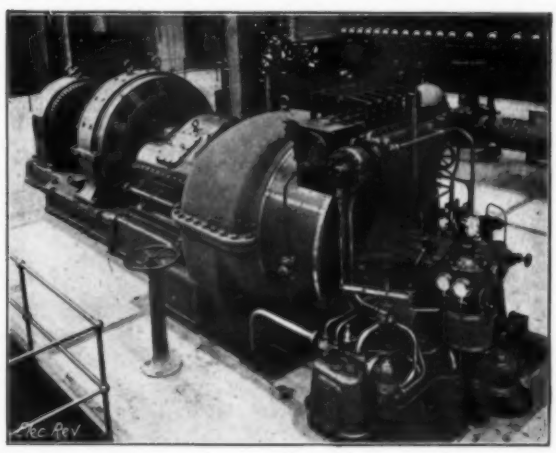

Fig. 11.—Auxiliary Turbine Set.

low-pressure stages of the 10,000-kW turbines, so that the condensate is heated in stages, up to 212 deg. F., before passing to the hotwells. The auxiliary turbine is provided with single air and condensate pumps, but not with feed-water heaters. A closed system of air ventilation with water-tube coolers is used with each 10,000-kW alternator. The cooling water is taken from the main circulating system. The auxiliary alternator and generator are cooled by natural ventilation. A 75-ton electric crane spans the turbine room and railway bay.

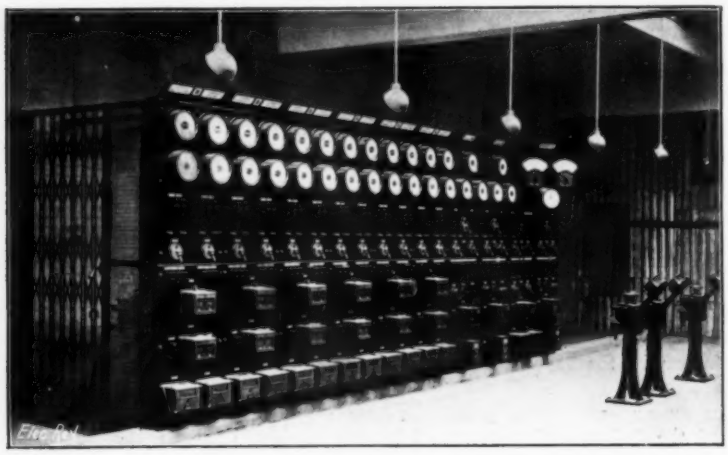

Fig. 12.—Control Chamber.

With the exception of the boiler feed pumps, the whole of the auxiliary plant is motor driven, either by 3-phase, 415-V, or by 480-V d.c. machines. The auxiliary power supply is normally obtained from static transformers for the 3-phase motors, and from rotary converters for the d.c. machines. The auxiliary turbo-alternator-dynamo may be used in parallel with either or both services, and is of sufficient capacity to start up the auxiliary motors of one complete (40,000 kW) section of the station, in the event of a total shut-down of the main plant. A storage battery is used in parallel with the d.c. auxiliary service, and is accommodated in a separate room.

The condensing water is pumped from and returned to the river, for which operations two open and parallel water channels, 10 ft. wide, have been constructed.

Four screens of the continually-moving-band type are provided at present, and similar arrangements will be made as further sections of the station are built. The condenser pumps for the 10,000-kW machines are each of 870,000 gal. per hour capacity, and the one for the auxiliary turbine has a capacity of 102,000 gal. per hour. A 5-ton hand crane serves the pump chamber.

The switchgear is divided into three sections: E.h.p. main switchgear, 11,000 V; e.h.p. auxiliary switchgear, 11,000 V; and l.p. auxiliary switchgear, for 245 and 490 V d.c., and 420 V a.c. The main switchgear is erected on two floors above the centrifugal pump room. The upper floor contains the oil switches and reactors, fig. 13, while on the lower floor, fig. 14, are the bus-bars, isolating switches, instruments, relay transformers, &c. The switchgear is divided into sections, with independent sectional bus-bars, continuous transfer bus-bars, and continuous tie bus-bars. Duplicate oil switches are provided for each alternator and single oil switches for each feeder. The section bus-bars will normally be coupled through reactors to the tie bus-bars. The transfer bus-bars will be used when it is desired to clean or examine any individual set of section bus-bars, by making the necessary change-over through the medium of the link switches. A separate set of reactors connects the transfer bus-bars to the tie bus-bars. In cases of emergency two or more sets of section bus-bars can be coupled together, independently of the

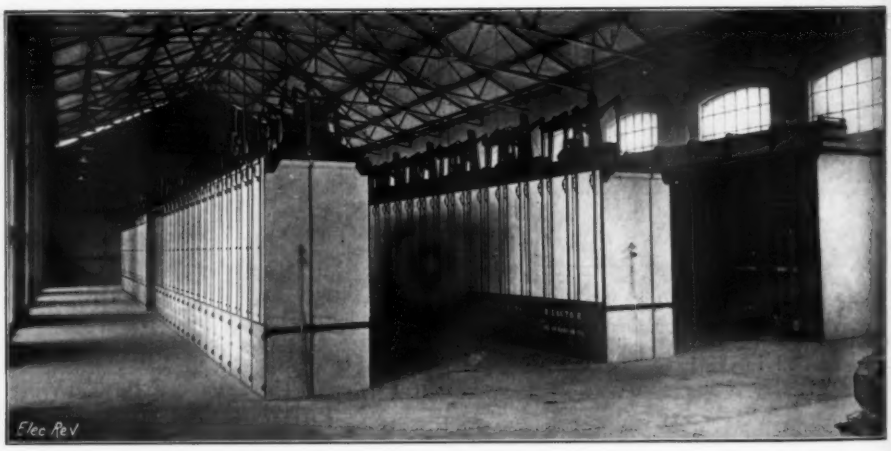

Fig. 13.—Oil Switches.

Fig. 14.—Bus-bar Room.

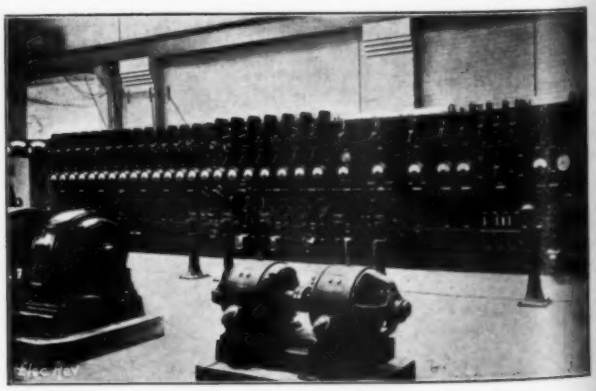

Fig. 15.—Auxiliary Switchgear.

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tie bus-bars, by means of the section coupling switches. The alternator oil switches are designed for 2,000 A per phase, and the feeder oil switches for 500 A per phase, in each case at 11,000 V. Each oil switch will, with the current-limiting reactors suitably arranged, safely open under short-circuit conditions, with an ultimate station working capacity of 200,000 kW. The whole of the main oil switchgear is operated electrically from a control switchboard, fig. 12, erected on a gallery above the auxiliary-plant bay, which commands a complete view of the turbine room. The operation is by d.c. at 240 V. The control gallery is laid out for the future accommodation of alternator and feeder control switchgear for 230,000 kW. An electric signalling apparatus is provided on the control gallery, by which independent signals can be given to the starting platform of each main turbine. When the alternator has been switched in, the switchboard attendant takes control of the speeds and the division of the load, by electrical control of the governors of the turbines.

An iron grid resistance, erected in an expanded metal enclosure between the turbine room and the auxiliary plant bay, is used to earth the neutral star point of the stator of one or other of the running alternators.

The low-pressure auxiliary switchgear, fig. 15, is mounted on slate panels, erected on the floor of the auxiliary plant bay. It controls the low-pressure sides of the station transformers and rotary converters, the accumulators, the booster, &c., and also the whole of the direct- and alternating-current motor and lighting services of the station. Separate starting and control switchgear is mounted close to each individual motor throughout the power station. The motors operating the coal- and ash-conveyor lines can be instantly stopped, from a number of points, by pressing special trip switches.

(To be concluded.)

Lighting and Power Notes.

Barrow.—LOANS SANCTIONED.—The Town Council has received sanction to the borrowing of £23,500 for mains, and £1,090 for the erection of a cooling tower.

Birkenhead.—ELECTRICITY CHARGES.—The Corporation has decided that from the September quarter the price of electricity to the out-townships shall be fixed at 25 per cent. above the rates charged in the borough, *viz.*: Lighting, 6¼d. (borough 5d.); heating and cooking, 1¼d. (borough 1d.); there will be special rates for large consumers.

Brecon.—AMENDMENT OF ORDER.—Application has been made by the Corporation to the Electricity Commissioners to amend the draft of a Special Order, so as to include the parishes of Castle Inn and Christ's College, as well as the urban district of Brecon.

Burton-on-Trent.—ELECTRICITY SUPPLY.—The Town Council, following an application from the Hartshorne and Seals Rural District Council for a supply of electricity to the pumping station at Smisby at an approximate cost of £2,000, has applied for consent to carry out the extension. The mains are to be extended forthwith to Barton-under-Needwood at an estimated cost of £2,500.

Carlisle.—LOANS.—The City Council has received from the Electricity Commissioners sanction to a loan of £7,000 for mains. A further loan of £11,108 has been applied for in connection with the laying of mains under an unemployment scheme, and a grant towards the cost is to be sought from the Unemployment Grants Committee.

Chichester.—LOANS.—The Town Council is applying for sanction to loans of £2,000 for electrical apparatus to be let out on hire, and £2,000 for feeder cables.

Denholme.—OPPOSITION TO SCHEME.—The Urban District Council is to oppose the proposal of the Electrical Distribution of Yorkshire, Ltd., to supply electricity in the district under the Queensbury and District Electricity Order, in view of the proposal that the Council shall supply electricity itself.

Felixstowe.—ELECTRICITY IN BULK.—The Urban District Council has entered into an agreement with Ipswich Corporation for a bulk supply of electricity for a period of 21 years.

Fylde.—ELECTRICITY AGREEMENT.—At a meeting of the Rural District Council on September 2nd, reference was made to the supply of electricity to Marton and Carleton. The deputation appointed at the previous meeting had met representatives of the Poulton Council, and the draft form of agreement for the supply of current to Carleton and Marton by the Blackpool Corporation was approved subject to slight alterations.

Hove and Aldrington.—YEAR'S WORKING.—The report of the borough electrical engineer, Mr. C. B. Smith, on the working of the electricity undertaking for the year ended March 31st shows a total income of £64,454, as compared with £58,949 in the preceding year. Working expenses amounted to £33,812, as against £30,395, leaving a gross profit of £30,642 (£28,554). After providing for capital charges, a net surplus of £9,707 remained, as compared with £7,715 in 1923-24. The amount spent on capital account during the year was £36,344, and was chiefly incurred on mains and machinery. The electrical energy sold increased from 2,456,258 to 2,883,308 kWh. Reductions in the charges for electricity were made during the year, and the engineer has recommended the following further reductions as from September 30th:—Lighting: From 6¼d. to 6d. per kWh. Power: From 2¼d. to 2d. per kWh. Meter rents: A reduction of 1s. per quarter per meter.

India.—MYSORE HYDRO-ELECTRIC EXTENSION.—The total supply now being generated at Sivasamudram is about 32,000 h.p., and the whole of this power has been already taken up. The immediate demands for additional power aggregate to about 10,264 h.p. Proposals were accordingly called for to utilise the additional supplies that could be made available from Krishnarajasagara, for some time to come, and the chief electrical engineer has submitted the seventh installation proposals and estimates amounting to Rs. 87 lacs, providing for the generation of 14,000 h.p. at Sivasamudram and 10,000 h.p. at the Krishnarajasagara-Dam site, together with the necessary transmission line, and the remodelling and extension of the receiving stations and distribution system in Kolar Gold Fields, Bangalore and Mysore cities. After consideration of the matter, the Government has sanctioned the scheme for the development at the Sivasamudram generating station and for the subsidiary works to transmit and distribute the additional 14,000 h.p. to the Kolar Gold Fields, Bangalore and Mysore, at a total approximate cost of Rs. 45½ lacs, postponing the development of the Krishnarajasagara station for the present, and the chief electrical engineer has been requested to submit detailed estimates and specifications for the plant and machineyr. It is expected that the first unit of the extensions will be put into service 18 months from the commencement of the work, and the whole work will be completed in 36 months.

Motherwell.—LOANS SANCTIONED.—The Town Council has received sanction to the borrowing of £2,841 and £428 in respect of mains and services required in the Coltness and Gerviston housing areas.

ELECTRICITY IN BULK.—The Electricity Commissioners, having considered the question of installing additional plant at the power station, or alternatively, taking a bulk supply from the Clyde Valley Electrical Power Co., are of opinion that the Council should arrange for taking bulk supply from the company. It is estimated that modern plant required at the station would cost £35,000.

PRICE REDUCTIONS.—The Town Council has reduced the charges for electricity for private lighting from 4¼d. to 4d. per kWh, and the combined rate for domestic purposes from 1d. to ¾d. per kWh.

Mynddislwyn (Mon.).—ELECTRICITY EXTENSIONS.—The Urban District Council has received sanction to the borrowing of £19,700 for extension of its electricity supply, and it is proposed to include Ynysddu, Cwmfelin, and Brynwel in the scheme.

Northern Ireland.—WHITEHEAD (CO. ANTRIM).—At the recent meeting of the Town Commissioners, the proposed electricity scheme for the district was considered, and it was resolved to advertise for quotations as soon as the necessary maps and valuations had been obtained.

Oldham.—NEW STATION SANCTIONED.—At a recent meeting of the Electricity Committee, a letter was received from the Electricity Commissioners consenting to the establishment of a generating station in the urban district of Chadderton. Mr. R. Blackmore, consulting engineer, reported upon the result of an interview which the engineer and himself had with representatives of the Unemployment Grants Committee with regard to the Electricity Committee's application for assistance in connection with the establishment of the new generating station, and submitted an estimate of the expenditure which would be incurred in the event of the committee's deciding to proceed with the installation of two 12,500-kW sets and four boilers instead of the complete first section of the station as originally intended. The estimate was adopted, and the Town Clerk was requested to apply to the Unemployment Grants Committee for a grant in respect of the sum of £207,375, which represents the difference between the scheme as originally submitted and the cost of the section which it is now proposed to put in hand.

Portsmouth.—LOAN SANCTIONED.—The Electricity Commissioners have sanctioned a loan of £65,000 for the extension of plant and buildings at the Corporation generating station.

Sheffield.—MAINS EXTENSIONS.—The Electricity Committee is to carry out mains extensions at a total cost of £6,516.

ELECTRICAL DEVELOPMENT.—The Finance Consultative Committee has approved new capital expenditure of £82,321 on the electricity supply account for the ensuing half year. The Electric Supply Commitee has approved during the past month extensions of mains involving a total expenditure of £9,737.

Southend-on-Sea.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer: Mr. R. Birkett) for the year ended March 31st last show a total income of £158,953, as compared with £138,341 in the preceding year.

Working expenses amounted to £84,876, as against £85,014, leaving a gross profit of £74,077 (£53,327). To this was added a balance of £18,883 brought forward from the previous year, and other small items making a total of £93,196. This was distributed as follows: Interest loan charges, &c., £46,491; capital expenditure charged to revenue, £22,814; house property at Boston Avenue and Thorpe Bay, £114; removal of No. 1 engine, £42; balance carried forward, £23,563. The capital expenditure during the year amounted to £61,132, and included £41,626 for mains and services, and £11,074 for engines, boilers and other machinery. The sales of electrical energy increased from 9,908,874 to 11,591,812 kWh, and the maximum supply demanded from 5,510 to 6,236 kW.

Sunderland.—LOANS SANCTIONED.—The Corporation has received sanction to the borrowing of the following amounts:—Sub-station buildings, £1,731; house services, £10,000; sub-station on the Barley Mow estate, £1,260.

Tregaron.—ELECTRICITY SCHEME.—The Town Development Committee is to carry out an electric lighting scheme for the town. It is proposed to utilise hydro-electric power.

Truro.—ELECTRICITY SCHEME.—The Town Council has accepted the offer of Edmundsons' Electricity Corporation, Ltd., to supply the city with electricity at 10d. per kWh for lighting and 5d. per kWh for power without any financial liability to the rates.

Ulverston.—LOANS.—The Urban District Council has received sanction from the Unemployment Grants Committee to a grant of 50 per cent. of the interest on a loan of £9,793, and also the sanction of the Electricity Commissioners to a loan of £11,675 for electricity purposes.

Walton-le-Dale.—ELECTRICITY SUPPLY.—The Urban District Council has approved a draft agreement with the Lancashire Electric Power Company and consented to its application for an Order to supply electricity in the district.

Wirral.—OPPOSITION TO SCHEME.—On the ground that the electricity scheme of the Wirral Rural District Council would saddle the district with a heavy liability, a public meeting of Moreton ratepayers has raised opposition to the scheme. The meeting was in favour of the offer of the Birkenhead Corporation which amounted to a supply of electricity at a cost of 25 per cent. less than under the Wirral Council's scheme. Mr. C. R. St. John, consulting engineer to the Wirral Council, stated that Birkenhead having been definitely refused any extensions by the Electricity Commissioners, could not get the necessary powers to supply Wirral. The chairman of the Birkenhead Electricity Committee said that if his authority were given powers, it could guarantee a bulk supply to Moreton within four to six weeks.

York.—ELECTRICITY EXTENSIONS.—The Electricity Committee is expending large sums on extensions and new machinery at the generating stations at Foss Island and Linton-on-the-Ouse, and in order to inspect the two stations and the progress of the work, members of the Corporation recently visited the sites. The Committee is installing a new Oerlikon turbine of 6,000-kW capacity, the condensing plant for which is being fitted by Messrs. W. H. Allen, Sons & Co., of Bedford. This will be the third Swiss generator to be included in the equipment. A new converter of the La Cour type is being placed in the station on the site of the Diesel engines, which have been removed. A new gallery is being erected to receive a h.p. switchboard, and four new water-tube boilers are being added to the equipment, making twelve in all. Further extensions are contemplated. The Chairman stated that as soon as the new 6,000-kW turbine at Foss Island was completed another would be installed.

"ALL-ELECTRIC" HOUSES.—The Town Council is to fit up four experimental houses, which are to be "all electric," on the lines of those at Gateshead. The estimated cost of fitting up each house with electrical apparatus is £50.

Tramway and Railway Notes.

Continental.—THE TYROL.—Plans are being prepared by an Innsbruck syndicate in connection with a proposed electric mountain railway between Langen, *via* the Flexen Pass to Zurs on the Arlberg in the Tyrol.

AUSTRIA.—Negotiations are reported to be in progress regarding the financing of the work of electrifying the Semmering section of the State railways.

ITALY.—A concession has recently been granted for the construction of an electric railway between Penne and Castellammare Adriatica.

Glasgow.—FARES.—A sub-committee of the Tramways Committee has decided in favour of the re-introduction of halfpenny fares on the tramway.

Grimsby.—RAILLESS CARS.—The Corporation contemplates the introduction of a system of railless cars to replace the local tramway which it has acquired.

Heywood.—TRACK RENEWALS.—According to the *Electric Railway and Tramway Journal*, at a recent meeting of the Town Council it was reported that a double tramway track is to be laid along Middleton Road for the Manchester trams from Middleton to Heywood. Application has been made to the Unemployment Grants Committee for a grant towards the cost of the scheme.

London.—TRAMCAR FIRE.—A fire, believed to have started in a fuse-box, caused flames to envelop part of a tramway-car in Vauxhall Bridge Road, opposite Regency Street, on September 13th. The passengers rapidly got out, and the driver smothered the flames with sand until the fire brigade arrived. Some of the body-work of the car was badly damaged before the fire was put out.

Morocco.—RAILWAY ELECTRIFICATION.—Work is well in hand on the electrification of the Casablanca-Khourigat, Casablanca-Rabat, and Casablanca-Marrakech sections of the Morocco Railway. The necessary electrical energy will be supplied from two power stations—a steam-operated one at Roches-Noires, Casablanca, and a hydro-electric plant on the Oum-Er-Rbia at Sidi-Said-Machou. Four transformer stations, to which current will be transmitted at 60,000 V, are being established at Casablanca, Skerat, Sidi-el-Aidi, and Mrizig. The first-named station will be manually controlled, while the other three will be automatic. Each sub-station will comprise two sets of 60,000/5,500-V transformers and 1,500-kVA synchronous converters.

Southend-on-Sea.—YEAR'S WORKING.—The report on the working of the Corporation tramway undertaking (manager: Mr. R. Birkett) for the year ended March 31st last records a total revenue of £126,979, as compared with £128,780 in 1923-24. Working expenses increased from £103,141 to £106,325, leaving a gross profit of £20,654 (£25,639), to which was added a balance of £12,090 brought forward from the preceding year, and bank interest of £339, making a total of £33,182. After deducting interest and other charges, there was a net surplus of £8,282. The amount spent on capital account, which included £16,289 for cars, was £30,353. The number of passengers carried increased from 17,891,287 to 21,732,269, and the car-miles run from 1,999,437 to 1,363,620. The total revenue per car-mile fell from 25.63d. to 22.42d.

Telegraph and Telephone Notes.

Australia.—PACIFIC CABLE.—The carrying capacity of the Pacific cables is being increased by the laying of a new loaded cable on the route Suva-Fanning-Bamfield, and, according to a correspondent of the *Daily Telegraph*, official circles in Australia regard it as essential to raise the capacity of the Atlantic connections to the same working speed; otherwise the traffic will be delayed in the "Atlantic bottle-neck." It is suggested that the best course would be for the Pacific Cable Board to lay a new loaded cable in the Atlantic.

China.—WIRELESS CONCESSIONS.—It is reported that the American Minister at Peking has demanded confirmation of a concession granted to the American Federal Wireless Company in 1921, and that the Japanese Minister demands similar confirmation for a prior concession to the Mitsui Company, dating from 1918. A third concession, it is said, similar to these two, was negotiated for in 1914 by the British Marconi Company. It is understood that the British Government favours the establishment of a joint working arrangement.

Czecho-Slovakia. — LONG-DISTANCE TELEPHONY.—Contracts have recently been let for the establishment of a long-distance telephone line between Prague and Kolin.

Italy.—THE NEW ITALO-ARGENTINE CABLE.—It is reported from Rome that the new cable between that city and Buenos Aires, *via* Madeira and St. Vincent, is nearing completion. The cable is to be formally inaugurated by the King of Italy on October 12th (Columbus Day).

Persia.—MILITARY RADIO INSTALLATION.—A recent report on Persia by Mr. R. H. Hadow, M.C., of the British Legation at Tehran, states that the Persian Army is engaged in constructing near that city a long-range radio installation with which it is hoped to communicate with Moscow and Beirut. Russian engineers are being employed, but Persians are to be trained to take their places. Similar but minor installations are projected at the various divisional headquarters of the Army, the places mentioned being Meshed, Shiraz, Tabriz, Hamadan, and possibly others.

Spain.—ANGLO-SPANISH CABLE.—A new cable between this country and Spain, 500 miles in length, was landed at Bilbao on Sunday by the cable-ship *Colonia*, which took only a week to perform the service. The new cable belongs to the Direct Spanish Telegraph Co., Ltd., which forms one of the undertakings which make up the Eastern Associated group.—*The Times.*

Switzerland.—UNDERGROUND TELEPHONE LINES.—In conjunction with the work of electrifying the Swiss Federal Railway system, the Swiss Telegraph Department has for some time been engaged in substituting underground for overhead telephone lines along the railway. The work of conversion has just been completed between Geneva and Winterthur and between Olten and Basle, while that between Winterthur, St. Gall, and Rorschach is well in hand.

Radio Notes.

Birmingham.—NEW PLANT.—New transmitting plant has been installed at the Birmingham station (5 IT), and is now working. The new apparatus embodies all the latest improvements, and it is claimed by the B.B.C. engineers that this station is now equipped in a manner which will bear favourable comparison with any broadcasting station in Europe. The new transmitter is built on lines similar to the plant at the Daventry high-power station, and a notable feature is the water-cooling system employed for one of the four valves which are used, a gallon of water per minute being kept in circulation round this valve in order to keep it at the right temperature.

Reports from listeners in many parts indicate that with the new plant considerable improvement in the quality of the transmissions has been effected. The input power has been increased from 0.5 to 1 kW. The old transmitting aerial at Summer Lane power station will continue to be used, but the studio controls will shortly be transferred to new premises in Broad Street, where a new method of draping is to be used which is expected to improve still further the quality of transmission.

International Broadcasting. — WAVELENGTH TESTS. — The tests conducted during the past two weeks relating to the effectiveness of the new schedule of wave-lengths provisionally allotted to British and European stations have been concluded for the present, and the results are being examined. Great improvements were effected by slight alterations after the earlier tests. The new station of the B.B.C. at Keston has been particularly useful in this connection; it is situated on a site of 30 acres, several hundred feet above sea level, on the border of Kent and Surrey. Besides checking wavelengths and identifying transmissions which cause interference, it will be used for receiving and relaying foreign programmes.

Italy.—BROADCASTING STATIONS.—A broadcasting station which is being erected for the Italian Broadcasting Co. at Milan by the Marconi Co. will have a type "Q" transmitter with a power of 6 kW. The new broadcasting station at Rome, which is also being erected by the Marconi Co., will be of the same type as the new 2LO, and will have a power of 12 kW.

Spain.—BROADCASTING DEVELOPMENT.—In connection with the Union Radio broadcasting station at Madrid, which was inaugurated in June, it is proposed to work out an elaborate relaying system. According to a recent report, relay stations are to be built at Barcelona, Seville, Valencia, Cadiz, Santa Cruz de Tererife, Coruña, Oviedo, Santander, Bilbao, Palma de Mallorca, Granada, Salamanca, Pamplona, Logrono, Valladolid, and Malaga. By this means it is hoped to cover the whole of Spain and the Balearic and Canary Islands.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—November 9th. Electricity Commission of Victoria. 6,600-V and l.p. lead-covered and armoured cable. 22,000-V, 3-core cable and accessories. (September 4th.)

P.M.G.'s Department. November 10th. Telephone receivers and parts.

November 17th. Magneto-automatic junction material.*

Belgium.—ANTWERP.—October 19th. Port Equipment Department. One 30-ton electric travelling crane. (A.X. 2,380.)*

Bournemouth.—September 24th. Tramways Committee. 20 bogie electric tramcars. Specifications from Mr. I. Bulfin, general manager, Tramway Offices, Wootton Gardens.

Brentford.—September 22nd. Board of Guardians. Electric wiring, &c., at the Institution, Warkworth House, Isleworth. (September 4th.)

Dublin.—September 29th. Port and Docks Board. 28 pairs of tramway-type switches (chilled iron with manganese steel tongues). Specifications from the Engineer's Office, East Wall, Dublin.

Gainsborough.—October 17th. Urban District Council. Generating plant, mains, transformers, and meters. (September 4th.)

India.—India Store Department. October 14th. L.p. turbine-driven d.c. generating set, condensing plant, and accessories. (See this issue.)

Leeds.—September 23rd. Board of Guardians. Electric lighting installation at the Institution, 3, Green Hill Road, Armley. Form of tender from Mr. J. H. Ford, clerk to Guardians, Poor Law Offices, South Parade.

London.—H.M. OFFICE OF WORKS.—September 24th. Electric wiring installation at the White Wing, British Museum. (September 4th.)

METROPOLITAN ASYLUMS BOARD.—October 7th. Installation of a fire-alarm system at Tooting Bec Hospital. (September 4th.)

SOUTHWARK.—September 23rd. Electricity Department. Twelve months' supply of electric cables. (September 11th.)

HAMMERSMITH.—September 23rd. Electricity Department. Construction of an underground water-tight ferro-concrete pump chamber and overhead pump house at Chancellor's Wharf; also supply of coal for the electricity works. Specifications from the borough electrical engineer.

LONDON COUNTY COUNCIL.—Highways Committee. October 12th. H.p. and l.p. switchgear for Shoreditch L.C.C. tramway sub-station. (See this issue.)

New Zealand.—CHRISTCHURCH.—January 5th, 1926. Drainage Board. Three electric sewage pumps. (AX. 2349.)*

WELLINGTON.—Post and Telegraph Department. October 27th. Rubber insulated wire.*

Public Works Department. November 24th. Neutral earthing reactors.*

Portsmouth.—September 30th. Board of Guardians. Three months' supply of electrical fittings and lamps. Forms of tender from the Guardians' Offices, St. Michael's Road, Portsmouth.

Richmond, Surrey. — September 24th. Board of Guardians. Installation of electric lighting, including wiring and fittings, at the Grove Road Institution, Richmond. Specifications from Mr. T. J. R. Kiernan, consulting engineer, 17, Victoria Street, S.W.

South Africa.—JOHANNESBURG.—S.A. Railways. October 15th. Incandescent lamps.*

October 20th. Electric cables and wires.*

CAPE TOWN.—October 14th. Electricity Department. Electric motors.*

Spain.—March 10th, 1926. Spanish General Direccion de Obras Publicas, Madrid. Supply of electricity for the operation of the Spanish section of the Ripoll-Aix-les-Thermes railway, which is at present being electrified.

Stoke-on-Trent.—October 12th. Electricity Supply Department. Two sets of steam air ejectors, and one centrifugal oil purifier. (See this issue.)

Warrington.—September 22nd. Board of Guardians. Six months' electrical supplies for the Whitecross Institution, Warrington, and the cottage homes, Padgate. Particulars from the clerk.

Workington.—September 15th. Corporation. L.p. cables and services. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Barnes.—Urban Council. Accepted:—
Additional distributor cable (£386).—Macintosh Cable Co., Ltd.

Barnsley.—Electricity Committee. Recommended:—
Ash elevator and storage bunker (£880).—W. J. Jenkins & Co.

Birkenhead.—Electricity Committee.
One 100-kVA transformer (£455).—Metropolitan-Vickers Electrical Co., Ltd.

Bradford.—Electricity Committee. Accepted:—
Unit-type switchgear for the Valley Road generating station.—Parmiter, Hope & Sugden, Ltd.

Dewsbury.—Town Council. Accepted:—
Re-wiring the Town Hall buildings for electric light (£969).—Ward & Co., Ltd.

Dover.—
Electrical installation work (including wiring, &c.) at shop and private residence, 93, High Street, Dover.—J. S. Etheridge & Co.

France.—The Relay Automatic Telephone Co., Ltd. (Paris branch), has received a contract for a new 3,000-line automatic public telephone exchange for Fontainebleau. The apparatus will be of the same type as that supplied by the company to the British G.P.O. for public exchange service.

Glasgow.—Baths Committee. Accepted:—
Electrical installation at Pollokshaws baths (£610).—Johnston, Park and Co.

Markets Committee. Accepted:—
Renewal of electrical work at markets (£187).—Johnston, Park & Co.

Tramways Committee. Accepted:—
D.c.c. wire.—W. T. Henley's Telegraph Works Co., Ltd.
Street poles.—Bromford, Ltd.
Trolley wire (cadmium).—R. Johnson & Nephew, Ltd.
Trolley wire (h.d. copper).—F. Smith & Co., Ltd.

Heywood.—Electricity and Tramways Committee. Accepted:—
Single-phase house-service meters.—Ferranti, Ltd.

Lamp Contracts.—H.M. Office of Works has placed contracts for nine months' supplies of electric lamps with Siemens & English Electric Lamp Co., Ltd., and the General Electric Co., Ltd.; the British Thomson-Houston Co., Ltd., has received contracts from the Admiralty and the Office of Works for supplies of "Mazda" vacuum and gasfilled electric lamps.

Northampton.—Town Council. Accepted:—
Installing electric lighting fittings at the Town Hall (£465).—Northampton Electric Light Co.

Ramsbottom.—General Purposes Committee. Accepted:
Electric light installation at Technical School.—T. Kay.

Weymouth.—Electricity Committee. Accepted:—
Dismantling and re-erecting battery and supplying new positive plates for cells, &c. (£786).—Tudor Accumulator Co., Ltd.

Forthcoming Events.

N.A.R.M.A.T. Wireless Exhibition.—At Royal Albert Hall, S.W. September 11th to 23rd.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, September 19th. At the South Wales Institute of Engineers, Park Place, Cardiff. At 6 p.m.

Cycle and Motor Cycle Show.—At Olympia, W. Opens Monday, September 21st.

Salford Technical and Engineering Association.—Wednesday, September 23rd. Visit to Messrs. Ferguson, Pailin, Ltd.

Radio Society of Great Britain.—Wednesday, September 23rd. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 6 p.m. Address on "The Mechanism of Radiation," by Sir Oliver Lodge, F.R.S.

Notes.

The London Traffic Inquiry.—On October 19th, the London and Home Counties' Traffic Advisory Committee is to commence its first inquiry into the lack of transport facilities in certain parts of the area which comes within its terms of reference. This initial inquiry will concern the North-Eastern suburbs from which numerous complaints have been received. The evidence of a number of public bodies and private individuals will be heard and suggestions for improvement will be considered.

Legal.—THEFT OF ELECTRICITY.—Convicted at Edinburgh for stealing 132 kWh of electricity, a man was fined £2. It was stated that the supply to his house had been cut off, but an engineer who called later found that the cables had been reconnected, the connection being so made that the current did not pass through the meter. The man pleaded that he was unaware that a disconnection had been made.

Individually Driven Textile Machinery.—The author of the article which appeared under this title in our last issue (Mr. A. Haigh) asks us to insert the following correction to the first paragraph on p. 410:—The saving by the use of "high performance" motors in place of ordinary machines should be £600 per annum and not £60, showing a return on the extra capital outlay of 240 per cent., and not 25 per cent.
The error occurred in the original MS.

Educational.—WILLESDEN POLYTECHNIC.—An exhibition of students' work is being held at this Institute during next week. The exhibition will be opened on Monday evening next by the Rt. Hon. T. J. Macnamara, P.C.; admission will be by ticket only. On the other evenings admission will be without tickets. The work shown by the Electrical Department will be one of the many special features of the Institute's activities.
UNIVERSITY COLLEGE, LONDON.—We have received the syllabus and particulars of the general arrangements for the 1925-26 session of the University College, London, Faculty of Engineering. The session commences on October 5th. The department of electrical engineering provides for university degree and diploma courses besides special training courses, &c.
THE POLYTECHNIC.—A two-years' course has been arranged for at the Polytechnic, Regent Street, in illuminating engineering. The course provides lectures in light and optics, electrical engineering and practical mathematics.
BRADFORD MUNICIPAL TECHNICAL COLLEGE.—A special course has been arranged in the Electrical Engineering Department for fitters engaged in electrical machine shop work. The Bradford branch of the Electrical Contractors' Association awards prizes to the most successful indentured apprentices in the evening classes in electrical installation work.

New Underground Railway Link.—The London underground railway companies have placed a contract with Messrs. Walter Scott and Middleton for the construction of a short tunnel connection between the Piccadilly and City lines at King's Cross. This new link will enable the rolling stock of the latter line to reach the tracks of the former and proceed to Lillie Bridge Depôt for overhaul. This work is done at present at the Golder's Green depôt, where some relief is necessary owing to the additional strain thrown upon it since the Edgware extension was opened. Work on the new link line, which will be 400 yards long by 12 ft. 6 in. in diameter, is to begin almost at once. The tracks of the Piccadilly line are 73 ft. below the street level at King's Cross, and those of the City railway are 88 ft. below. The new tunnel will thus have a fall of 15 feet between the two railways. To facilitate the conveyance of material, &c., a working shaft will be driven at Midland Road to a depth of 90 ft. and a temporary tunnel will be constructed from this point to the City line. It is not anticipated that any part of the work will be done under compressed air. The construction of the physical connections with the existing tunnels of both the Piccadilly and City lines will be undertaken at night time to prevent any interruption of the traffic.

Fatalities.—Patrick Gallagher, employed at the Wheatley Hide Brickworks, Co. Durham, received a fatal electric shock on September 7th. He was carrying an iron rail upon his shoulder when it came into contact with an overhead wire.
ALLEGED PRACTICAL JOKE FATALITY.—A charge of culpable homicide has been preferred against Daniel Gray, who was remitted from the Glasgow Eastern Police Court to the Sheriff on Tuesday last week. The case is a sequel to what it is understood was intended as a practical joke in a works. A wire is alleged to have been attached from an electric switch to the handle of a door, which was caught by a labourer, who received a shock from which he died.

Electrical Association for Women.—Members of this Association will visit the St. Helens Cable and Rubber Co., Slough, to-morrow (Saturday). After the works have been inspected, tea will be provided by the company.

Crystal Sets in Hospitals.—The claims of the crystal set have to a large extent been overlooked in the movement for providing radio in hospitals. The multi-valve set, involving as it does high initial expense, does not fulfil all the requirements of the receiving set in a hospital, for it needs more or less skilled supervision if it is to be kept in continuously good working order. The crystal set, on the other hand, is cheap, it involves no extra cost in maintenance, and the set can be left permanently adjusted to the wave-length of the local station, thus giving the patients the pleasures of broadcasting with the same regularity and dependability as that which attaches to the use of electric light.
There is one noteworthy scheme which illustrates the possibilities of the crystal set in this direction. It is at the Birmingham General Hospital, where Doctor J. R. Ratcliffe, a well-known Birmingham medical man who combines professional knowledge with long experience as a wireless amateur, has wired one of the large wards for the use of crystal sets. The most interesting feature of the scheme is the fact that outside aerials are not used. There are four sets, installed inconspicuously in the corners of the ward, and each set is operated off an aerial consisting of rubber-covered wire which is suspended from a picture rail near the roof. All four aerials run close to each other and are therefore not unsightly, and the sets are connected to one common earth lead which is taken to the nearest water pipe. The output terminals of each set are connected to twin flex which is carried round and over the beds, a "bayonet" plug and socket joint being provided above each bed. The plug is fitted to the end of the 'phone leads, so that they can be inserted at will. The plugging-in of the 'phones is all that is necessary for the patient to be able to listen.
In many hospitals the likelihood of nails or screws having to be put into the walls, or holes made in the roofs or window frames, is offered as an objection to the provision of wireless, but this has been overcome in Doctor Ratcliffe's scheme. Where it has been necessary to attach the wire to the wall, it has been done by means of little rubber suction pads which cling tenaciously to the wall, the wire being passed through a small loop in the rubber.
It has been found that each of these four crystal sets will operate six pairs of 'phones quite effectively upon reception from the Birmingham station. The hospital is in an advantageous position, being within very close range of 5IT, but there can be little doubt that a similar arrangement of crystal sets and indoor aerials would prove quite successful up to a range of five or six miles from the transmitting station. There are many hospitals and similar institutions within this range of a main or relay broadcasting station which could be equipped throughout with radio, cheaply and effectively, on this crystal-set basis.

Railway Electrification in South Africa.—According to a special correspondent of *The Times*, the electrification of 267 miles of main-line railway in Natal has been carried out without disturbance to the ordinary traffic, which during the process exceeded all previous records. The outlay originally authorised by Parliament was £3,318,000, excluding the cost of electric locomotives, and the matter was treated as urgent, so that close estimates could not be made, with the result that the cost was under-estimated by £535,000, largely due to the severe curves and gradients. The Daimana-Mooi River section is in full electric operation, and the service between Glencoe Junction and Maritzburg will be at work early next year.

The Electrification of Palestine.—According to *Science*, a new engineering scheme which will use the sun's energy to provide electrical power for all Palestine, make water available for the irrigation of thousands of dry acres, and provide a new interior port for ocean shipping and canals for inland transportation, has been suggested by a French engineer, M. Pierre Gandillion, and accepted for execution by several French business men.
The project consists in utilising the falls that can easily be created between the Mediterranean and the Dead Sea by carrying the water of the Mediterranean over a 260-feet ridge by means of canals, pumps and a great siphon and then letting it drop to the Valley of the Jordan and from there down into the Dead Sea, a total vertical distance of more than 1,500 feet. The Dead Sea is an inland lake, and only as much water as the sun can easily evaporate will be thrown into it.

M. Gandillion estimates that the sun now evaporates all the water that the Jordan carries into the Dead Sea at the rate of about 92 cubic yards a second. That it used to evaporate much more is shown by a series of terraces at different levels on its borders, formed when the water was higher and the surface exposed to evaporation by the sun's heat therefore greater. The new plan will raise the level of the Dead Sea and evaporation by the sun will take care of the additional and regulated inflow. It is believed that an evaporation of 135 cubic yards a second is easily possible and the inflow from the Jordan is to be augmented by that amount.

The scheme will necessitate the building of a sea-level canal from the port of Haiffa to a point about four miles inland. It will end in a great basin where ocean steamers can turn. From there on, either navigable canals with locks or ascensional water pipes will be built to reach the ridge at Afoule, a way station. At that point a 1½-mile tunnel will be bored through the rock and the water will run into chambers at about 262 feet above the level of the Mediterranean and about 1,125 feet above that of the Jordan, where a hydraulic turbine will be installed. Another drop of 394 feet is available between the Jordan and the Dead Sea, making a total drop of over 1,500 feet.

In all, 617,000 horse power will be generated, says M. Gandillion. Of this, 190,500 horse power will be used to lift the 135 cubic yards of water a second from the Mediterranean over the 260-foot ridge, leaving enough power for the electrification of the entire Holy Land with its railroads, industries and agriculture.

The fresh waters of the Jordan and the Sea of Galilee need not be poured into the Dead Sea with the salt water of the Mediterranean, but can be diverted and used to irrigate thousands of acres of dry land.

B.E.A.M.A. Annual Dinner.—The annual dinner of the B.E.A.M.A. will be held at the Connaught Rooms on Thursday, November 19th, when the Rt. Hon. the Earl of Derby, K.G., president of the Association, will be in the chair.

Storage-Battery Locomotive Competition: The Prize Awarded.—Colonel G. R. Lane-Fox, M.P., Secretary for Mines, announces that the judges appointed to adjudicate on this competition for a prize of £1,000 which was offered by Mr. Charles Markham for the best type of locomotive for use underground in coal mines, have arrived at their decision. They award the whole of the prize to Messrs. Joseph Booth and Bros., Ltd., engineers, Union Foundry and Ironworks, Rodley, Leeds, whose design fulfilled the conditions of entry and was, in their opinion, the best that was submitted to them. The judges propose to present in due course a report of the competition and a summary of the technical results obtained at the trials under working conditions. This will be published as soon as it is available.

Appointments Vacant. — Electric workshop foreman (Rs. 575 per month), for the Eastern Bengal Railway (Indian State Railways); mains foreman, for the Stoke Newington Borough Council electricity department. (See our advertisement pages to-day.)

World Power Conference.—INTERNATIONAL EXECUTIVE COMMITTEE.—Meetings of the International Executive Committee was held on July 27th to 30th in London, at which it was provisionally agreed to hold the Second World Power Conference in Rome in 1930. A Sectional Meeting is to be held at Basle in 1926. Further particulars of the proceedings will appear in our next issue.

Electrical Looms at a College.—Two electrically-driven looms have been installed in the cotton department of the Wigan Mining and Technical College, for the practical training of students.

Modern Demonstration Methods for Electric Lighting.—The call for efficient methods of demonstrating the advantages of lighting by electricity increases as progress is made and competition in the lighting services becomes more keen. To bring itself up-to-date during the coming season, the Lighting Service Bureau has made considerable developments and improvements to its demonstrating rooms at 15, Savoy Street, London, W.C.2. The two main features in these improvements are the equipment of one room to demonstrate shop-lighting systems, and a revolving tower for the demonstration of domestic lighting. In the former four sections of the room are each equipped to represent an independent class of shop and thus create a proper atmosphere for the audience. At the time of a recent visit by us to this room, its sections were representing a confectionery, a grocery, a draper's, and a boot shop. Flap doors are arranged in the ceiling, which are opened to allow lighting fittings to pass to and from the false roof, where they are concealed when not required for demonstration purposes. The opening and closing of the doors and the raising and lowering of the fittings are controlled from a position outside the room by small winches. The revolving tower is an ingenious arrangement for contrasting the good and bad systems of domestic lighting. Except that the floor also revolves, the arrangement is similar to an installation of ordinary revolving entrance doors, the doors in this case representing the walls, which are divided into two sections, top and bottom, each section revolving independently of the other. Each compartment of the bottom section is suitably furnished to represent a portion of a room, while the top sections are equipped to show the good and poor methods of lighting the room, so that by one setting of the bottom half, two or more turns of the top half will allow the demonstration of that number of lighting systems for the one setting. Many new devices for demonstrating the uses of special fittings and lamps, &c., have been added to the rooms.

The Late Sir Adam Beck.—Writing editorially on the late Sir Adam Beck's career, the *Electrical World* says:—"Up to the time of his death Sir Adam remained the guiding genius of the Hydro-Electric Power Commission of Ontario. During the twenty years of his incumbency he was oftentimes a storm centre around whom waged many a heated controversy. 'Dictator' and 'tyrant' his opponents called him; yet, without adverting to the conditions under which Sir Adam worked his will, it can be said that throughout all his career he showed great resourcefulness, and to his dying day he retained the confidence and admiration of the people of the province. He popularised and increased the use of electricity in Ontario and created one of the greatest superpower systems in the world. Whether or not his work will endure time alone can tell. He was stricken in the height of his power, and it remains to be seen how Ontario's hydro system will get along now that its master mind is dead."

Institution Notes.

Institution of Public Lighting Engineers.—ANNUAL MEETING.—During the past week the Institution has been in conference at Leeds. On Monday evening the Lord Mayor and Lady Mayoress held an informal reception in the Art Gallery, and after dark the visitors made a tour of the city in charabancs to inspect the street lighting. The Conference commenced on Tuesday morning, with an address by the Lord Mayor, to which the president, Mr. S. B. Langlands, responded. The chairman of the Leeds Street Lighting Committee (Councillor E. J. Clarke) congratulated the incoming president, Mr. Shapley, who delivered his inaugural address, after which the members were entertained at luncheon by the Lord Mayor and the Street Lighting Committee. In the afternoon they went on a long excursion to Templenewsam and Harrogate. On Wednesday a paper was read by Mr. Lennox and one by the Distribution Department of the South Metropolitan Gas Co.

The Faraday Society.—A general discussion on "Photochemical Reactions in Liquids and Gases" is to be held at Oxford on October 1st and 2nd, 1925, Prof. F. G. Donnan, president, being in the chair. On Thursday, October 1st, from 3.30 to 5 and 5.30 to 7.30, Einstein's "Law of Photochemical Equivalence" will be discussed, Prof. A. J. Allmand (London University) reading an introductory paper. On Friday, October 2nd, from 10 to 1 and 2.30 to 5, the subject of discussion will be "The Mechanism of Photochemical Reactions," the introductory paper being read by Prof. M. Bodenstein (Berlin). Many papers will be read or communicated, and copies will be sent to all who have signified their intention of being present, and to those who specially apply.

The Röntgen Society.—The officers elected for the session 1925-6 are as follows:—President: Dr. F. W. Aston, F.R.S. Vice-presidents: Dr. Robert Knox, M.I.E.E., Dr. N. S. Finzi, and Prof. A. W. Porter, F.R.S. Hon. treasurer: Mr. Geoffrey Pearce. Hon. editor: Dr. G. W. C. Kaye, O.B.E. Hon. secretaries: Dr. E. A. Owen and Dr. R. J. Reynolds.

Diesel Engine Users' Association.—At the next meeting, which is to be held on Friday, October 9th, a paper by Mr. Edwin M. Bailey, on "The Scottish Shale Oil Industry" is to be read and discussed.

The Junior Institution of Engineers.—The opening meeting of the Winter Session will be held on Friday, October 2nd, at 39, Victoria Street, when a lecturette, "Problems of Broadcasting," will be delivered by Mr. H. Bishop, B.Sc. Further meetings will be held every Friday at the same place and time. The inaugural meeting of the 45th Session will be held at the Royal Society of Arts on Friday, December 11th, when Mr. J. S. Highfield, M.Inst.C.E., M.I.E.E., will be inducted president of the Institution by Dr. Alexander Russell and will deliver his presidential address.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

The Walsall Corporation has appointed as tramway manager Captain W. VANE MORLAND, M.Inst.T., the general manager and engineer of the St. Helens Corporation tramway and motor-bus undertaking. The salary is £800 a year, rising by £50 per annum to £900.

The Leigh Council last week decided to congratulate the borough electrical engineer and his staff upon their great success. It was stated that, with the exception of Stepney, Leigh was at the head of the electricity undertakings in the country with regard to low fuel consumption and thermal efficiency, and was the first so far as the Lancashire district was concerned.

MR. F. E. CHILTON has resigned his position as London sales manager to the Wellman Smith Owen Engineering Corporation, Ltd., and has joined the Perfecta Seamless Steel Tube and Conduit Co. (1923), Ltd., as manager of its London office, 66, Victoria Street, Westminster, S.W.1.

On leaving his post at the Willesden works of the North Metropolitan Electric Power Supply Co. on August 29th to take up the position of boiler-house superintendent at the North Wilford generating station of the Nottingham Corporation, Mr. L. MARSHALL JOCKEL, A.M.I.Mech.E., A.M.I.E.E., was presented by the staff and employés with a handsome silver salver as a token of the esteem which he had earned during the past five years.

MR. HUMPHREY F. FOSTER, of Messrs. Foster Bros., Ltd., Wednesbury, has just returned from a visit to the United States, where has has been studying the latest developments in high-pressure steam pipe practice.

MR. H. C. BABB, general manager of the Lothians Electric Power Co., celebrated his silver wedding on September 4th. On behalf of the departmental heads, he was presented with a silver tantalus.

It is announced from Toronto that Mr. CHARLES A. MAGRATH, chairman of the International Waterways Commission, has been appointed to the post of chairman of the Hydro-Electric Power Commission of Ontario, rendered vacant by the recent death of Sir Adam Beck. Mr. A. MAGUIRE, formerly Mayor of Toronto, has also been appointed to the Power Commission.

M. F. A. C. MAGNIER, director of the Société de Production et Distribution d'Energie Electrique, of Paris, has been appointed a Chevalier of the Légion d'Honneur.

MR. L. JESSOP, head of Messrs. Jessop & Boydell, Ltd., electrical contractors, of Bradford, has accepted nomination as the Liberal candidate for the Great Horton Ward in the forthcoming municipal elections at Bradford.

MR. W. R. SMALL, founder and late managing director of the Armorduct Manufacturing Co., Ltd., has resigned his position as managing director of the Anglo Electric Co., Ltd.

MR. ERNEST E. BRIGGS, M.I.Mech.E., A.M.I.E.E., has been appointed sales manager to Messrs. Thomas Cass & Co., Ltd., Bolton, Lancs., and will devote himself to the sales development of their new "Falcon" sprinkler stoker and self-cleaning furnace and other manufactures.

Mr. JAMES DUNCANSON, A.M.I.E.E., has recently resigned his position on the staff of the Glasgow Corporation Electricity Department, where he has been for over twelve years, to take up an appointment with Messrs. Caldwell & Co., Glasgow, makers of steering gear, cranes, and steam- and electrically-driven auxiliaries.

The Swansea Educational Committee has appointed Mr. REGINALD RICHARDS as lecturer on electrical engineering at the Swansea Technical College.

Barnes Urban Council has increased the salary of the electrical engineer, Mr. C. S. DAVIDSON, by £200 per annum.

Mr. R. F. PROCTOR, B.Sc., A.M.I.E.E., has been presented with a dinner service as a wedding present by the staff of the Research Laboratories of the General Electric Co., Ltd. Mr. Proctor was formerly at the National Physical Laboratory.

Obituary.—HERR F. HAFFERL.—The death recently occurred, at Linz, at the age of 68 years, of Herr Franz Hafferl, one of the chief directors of the Stern-Hafferl Gesellschaft, of that city, which owns a number of hydro-electric stations in Upper Austria.

Will.—The late Sir ADAM BECK, chairman of the Hydro-Electric Power Commission of Ontario, left estate valued at $600,000.

New Companies Registered.

Super Electric Carpet Beating and Cleaning Co., Ltd. (208,315).—Private company. Registered September 9th. Capital, £450 in 5s. shares. Objects: To acquire (1) the business of carpet cleaners and beaters carried on as the Imperial Carpet Beating and Cleaning Co. at 29, Hubbard Street, West Ham, and (2) the subsidiary business of the Re-Echo Electrical Manufacturing Co., Ltd. The directors are:—A. L. Leaver, 482, High Street North, East Ham, wholesale confectioner and tobacconist; R. G. Harley, 67, Woodford Road, Forest Gate, E.7, caterer; C. E. Harley, 149, Plashet Grove, East Ham, E.6; C. W. Martin, 823, Romford Road, Manor Park, E.12, grocer; W. E. Thorpe, 179, Bredmore Road, Goodmayes, corporate accountant; W. B. Pearson, 151, Plashet Grove, East Ham, E.6, corporate accountant (all permanent). Secretary: W. B. Pearson. Solicitor: W. H. Lane, 17, College Hill, E.C. Registered office: 5, John Street, Bedford Row, W.C.1.

Loveland & Co., Ltd. (208,332).—Private company. Registered September 10th. Capital, £1,000 in £1 shares. Objects: To adopt an agreement with H. F. Loveland for the acquisition of provisional specification of letters patent No. 5,605, dated March 2nd, 1925, for an "improved collapsible carrier for electric accumulators and the like," and to carry on the business of wireless, electrical, mechanical, motor and general engineers, manufacturers of and dealers in motor accessories, wireless instruments, parts and goods, transformers, radiators, motors and radio instruments of all kinds, &c. The directors are:—H. F. Loveland, 440, High Road, Streatham, S.W.16; G. E. Spencer, address not stated; H. W. Killick, address not stated; F. W. Knight, 41, Norbury Court Road, Norbury, S.W.16. Solicitors: T. H. Goodwin, 14/15, Coleman Street, E.C.

Ultra Electric, Ltd. (208,298).—Private company. Registered September 8th. Capital, £5,000 in £1 shares. Objects: To adopt an agreement with E. E. Rosen and A. I. Cornberg, trading as E. E. Rosen and Co. to acquire the registered trade mark "Ultra," and to carry on the business of electrical engineers, manufacturers of and dealers in goods appertaining to the wireless, electrical and engineering trades and industries, &c. The directors are:—E. E. Rosen, 288, Cricklewood Lane, N.W.10, radio engineer (chairman and managing director); A. I. Cornberg, 145, The Vale, N.W.10, merchant; Dr. G. Seibt, Haupstrasse 11, Schonberg, Berlin, merchant. Solicitor: H. S. Baron, 16, Fenchurch Street, E.C.3. Registered office: 661/663, Harrow Road, N.W.10.

Fleet Electric Co., Ltd. (208,352).—Private company. Registered September 11th. Capital, £1,000 in £1 shares. Objects: To carry on business as electrical, mechanical and general engineers, to acquire the right to use or manufacture and put up telephones, telegraphs, phonographs, accumulators, lamps, &c. The subscribers (each with one share) are:—M. Haar, 42, Queen's Road, Finsbury Park, N.4, electrical engineer; P. J. Quin, 125, Beaufort Street, Chelsea, S.W.3, company secretary. H. Haar is permanent managing director. Secretary: P. J. Quin. Registered office: 5, Hind Court, Fleet Street, E.C.4.

Brandwood, Ltd. (208,348).—Private company. Registered September 11th. Capital, £1,000 in £1 shares. Objects: To acquire the business of a manufacturer of and dealer in baby carriages, toys and cycles carried on by W. O. Brandwood at 1 and 1a, Priory Road, Anfield, Liverpool, as the "County Bassinette Co.," and to carry on the same and the business of electrical and mechanical engineers, makers of and dealers in wireless apparatus and electrical goods of all kinds, &c. The permanent directors are:—W. O. Brandwood, 2, Breck Road, Anfield, Liverpool, manufacturer; Mrs. M. N. Brandwood, 2, Breck Road, Anfield, Liverpool; L. Brandwood, 2, Breck Road, Anfield, Liverpool, bookkeeper; H. Brandwood, 2, Breck Road, Anfield, Liverpool, bookkeeper. Qualification, £10. Remuneration as fixed by the company. Secretary: L. Brandwood. Registered office: 1 and 1a, Priory Road, Anfield, Liverpool.

C. K. Hanbury, Ltd. (208,350).—Private company. Registered September 11th. Capital, £1,000 in £1 shares. Objects: To carry on business of dealers in wireless receiving and transmitting apparatus and all component parts used in connection therewith, &c. The directors are:—C. K. Hanbury, 20, Padiham Road, Burnley, electrician (permanent managing director and chairman); H. Hankey, Garrison Hotel, Padiham Road, Burnley, licensed victualler. Qualification, 100 shares. Remuneration as fixed by the company. Registered office: 20, Padiham Road, Burnley.

Official Returns of Electrical Companies.

Trust Electrical Accessories Manufacturing Co., Ltd.—A. R. Atkins, of 31, Twyford Street, N.1, ceased to act as receiver or manager on June 3rd, 1925. (Notice filed September 8th.)

W. J. Tough & Partners, Ltd.—E. J. Barnes, of 24, Cambridge Road, Gunnersbury, W.4, was appointed receiver and manager on August 24th under powers contained in debenture dated August 4th, 1925.

Fuller's United Electric Works, Ltd.—Prior lien debenture, constituting a first charge on the company's land, building and hereditaments, goodwill and uncalled capital, and a first floating charge on the company's other assets, dated September 1st, 1925, to secure £75,000. Holders: National Bank of Scotland, Ltd., 37, Nicholas Lane, E.C.

Archibald J. Wright, Ltd.—Debenture dated August 19th, 1925, to secure £1,000, charged on the company's undertaking and property, present and future. Holder: A. J. Wright, 66, Canonbury Park South, N.1.

Lancashire Telephone Systems, Ltd. — Deposit of deeds, without instruments, dated August 9th, 1925, to secure £500, charged on moneys due or to become due to the company in respect of certain contracts for the rental of automatic telephone instruments. Holders: C. S. Ashworth, The Homestead, Poynton, Cheshire, and others.

Continental Automatic Telephone and Electric Co., Ltd. (184,764).—Return dated December 31st, 1924 (filed April 8th, 1925). Capital, £10,000 in £1 shares. 1,302 shares taken up. £302 paid. £1,000 considered as paid. Mortgages and charges, nil.

L. W. Douthwaite & Co., Ltd. (185,649).—Capital, £7,000 in £1 shares. Return dated August 14th, 1924 (filed March 7th, 1925). 5,519 shares taken up. £1,321 paid. £4,198 considered as paid. Mortgages and charges, nil.

Scott Insulated Wire Co., Ltd. (183,890).—Return dated January 14th (filed February 13th), 1925. Capital, £14,000 in 4,000 preference and 10,000 ordinary shares of £1 each. 2,075 preference and 10,000 ordinary shares taken up. £12,075 paid. Mortgages and charges, nil.

Thames Valley Electric Supply Co., Ltd. (185,597).—Return dated April 16th, 1925. Capital, £100 in £1 shares. All shares taken up. £100 paid. Mortgages and charges, nil.

Weldrics (1922), Ltd. (185,661).—Return dated February 12th, 1925. Capital, £25,000 in £1 shares. 14,000 shares taken up. £1 per share called up on 12,500 shares. £12,425 paid, leaving £75 in arrears. £1,500 considered as paid on 1,500 shares. Mortgages and charges, nil. Return of allotments, made up to March 18th, 1925, shows 1,000 ordinary shares allotted for cash.

City Notes.

Reports and Meetings of Electrical Companies; Dividend Results, &c.

Ferranti, Ltd.

The annual meeting of the company was held in London on September 11th; Mr. A. W. Tait, C.B.E., chairman, presided. In submitting the report, he said that the net profit for the year, after making provision for general establishment charges, repairs and renewals, bad debts, taxation, and interest on debenture stock, and making the usual substantial allocation to depreciation reserve, was £67,644. The net profit for the previous year on the same basis was £55,545. The turnover for the year to June 30th, 1925, again showed a substantial increase over that of the previous year, to which increase all departments had contributed. The trading profit of £161,960 showed an increase of about £30,470 over that of the previous year. In the Meter Department there had been an increase both in quantity and value, and satisfactory progress had been made in the Power Transformer Department. The Instrument Department had also shown encouraging progress, and there was every reason to believe that the company's sales of radio apparatus would show still further increase during the current year. The sum of £15,000 had been transferred to the credit of the depreciation reserve account, as against £10,000, which had been the usual allocation for some years, and the amount standing at the credit of that

account was now £91,912. That was approximately equal to 35 per cent. of the total value of the fixed assets of the company. The balance-sheet was very satisfactory and showed the strong financial position of the company. As to the liabilities, the first mortgage debenture stock outstanding showed a decrease of £6,100, being the amount of stock redeemed during the year. They had also transferred to the credit of general reserve account the sum of £40,000, increasing the amount to the credit of that account to £165,000. The dividends on the preference shares had been paid, and the directors recommended the payment of a dividend on the ordinary shares of 20 per cent., free of tax, requiring £12,000, leaving £33,312 to be carried forward to the current year, which was an increase of about £6,124 on the amount brought into the account.

The chairman said that the position of the company was very sound. The liquid resources were ample for the company's present requirements, and, in addition, over £80,000 invested in War Loan and Treasury Bonds was available for the further expansion of the company's business. He did not propose to make any forecast with regard to the current financial year, except to say that they had started the year with a satisfactory order book, and the orders which had been received since that date showed an increase over the same period of the previous year. While business, particularly in the export markets, was difficult, and competition very keen, he believed that the company would obtain its share, and with the expansion of the electrical industry both at home and abroad, it would be able to continue the progress which it had made during the last four years, and, unless unforeseen difficulties arose, it would be possible to present an equally satisfactory account next year. The report and accounts were adopted.

Manila Electric Corporation.—A dividend of 62½ cents per share has been declared on the common capital stock in respect of the quarter ending September 30th.

It is reported that the board of the Associated Gas and Electric Co. has extended the time for the exchange of certain Manila Electric securities for the company's gold bonds to September 24th.

Alabama Traction, Light and Power Co., Ltd.—The South-Eastern Power & Light Co. has made an offer to exchange its 6 per cent. gold debentures, series "A," for the Alabama company's 5 per cent., first mortgage, 50-year gold bonds. A meeting of bondholders to consider the proposal is to be held in Montreal on October 7th.

British Aluminium Co., Ltd.—A dividend at the rate of 8 per cent. per annum has been declared on the ordinary shares in respect of the half-year ended June 30th last. This compares with an interim dividend at the rate of 5 per cent. last year.

Direct Spanish Telegraph Co., Ltd.—The board has decided to pay, in addition to the dividend for the half-year to June 30th, 1925, at the rate of 10 per cent. per annum on the preference shares, an interim dividend of 4 per cent., free of tax, on the ordinary shares.

British Electric Transformer Co., Ltd.—The accounts for the first half of the current year show a profit of £25,827, as compared with £1,236 for the first six months of 1924, and a loss of £19,959 for the equivalent period of 1923.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under rule 159:—
Aluminium Corporation.—£250,000 8 per cent. "B" debentures (registered) of £100 each, Nos. 1 to 2,500.
Oxford Electric Co.—£10,000 new 6 per cent. debenture stock.

Eastern Telegraph Co., Ltd.—The directors have declared a dividend at the rate of 3½ per cent. on the preference stock, less tax, and one of 2½ per cent., free of tax, on the ordinary stock, in respect of the quarter ending September 30th.

British Insulated & Helsby Cables, Ltd.—An interim dividend of 5 per cent. has been declared on the ordinary shares, as in 1924.

Globe Telegraph and Trust Co., Ltd.—Quarterly dividends of 3s. per share, less tax, on the preference shares, and 5s. net on the ordinary shares, have been declared.

Lisbon Electric Tramways, Ltd.—A dividend has been declared on the cumulative preference shares in respect of arrears from July 1st, 1917, to December 31st, 1919, less tax.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—An interim dividend of 2½ per cent. has been declared on the ordinary shares.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors have declared a dividend for the three months ended June 30th last of 5s. per share, free of tax.

Isle of Thanet Electric Supply Co., Ltd.—The dividend for the half-year ending September 30th on the 6 per cent. cumulative preference shares has been announced.

Midland Electric Corporation for Power Distribution.—An interim dividend at the rate of 10 per cent. per annum has been declared on the ordinary shares, as in 1924.

International Telephone and Telegraph Co.—The usual quarterly dividend (1¼ per cent.) has been declared by the directors.

Bromley (Kent) Electric Light and Power Co., Ltd.—A dividend of 9 3/5d. net per share has been declared.

Mackay Companies.—A quarterly dividend of 1¾ per cent. has been declared on the common stock.

Stocks and Shares.

MONDAY EVENING.

THE feature this week in the markets which deal with electrical and allied industries, is the strength that has developed amongst wireless shares. There has been a decided increase in the amount of interest taken by the public. After a long period of inattention, people have begun to buy Marconi shares again, and those of the parent company are up to 28s. 9d. Marines strengthened to 18s. 3d. Canadian Marconis, on the circulation of a variety of rumours, hardened to 5s. 9d. The amount of business passing in the group has quickened remarkably. It is difficult to point to any special reason for the revival. No doubt it was merely a coincidence that this happened to start immediately after the thirtieth anniversary of the invention of wireless, which was celebrated last week by a luncheon given to Senatore Marconi. The famous inventor humorously maintained that wireless existed when the prehistoric man first understood, or felt, the meaning of a smile of encouragement from the pre-historic girl, and, very modestly, all that he claimed to have done was to discover that electric waves were capable of travelling and being received across great distances.

The electricity supply market continues very firm. Various deductions from the prices were made last Thursday on account of dividends, and these have all been recovered. Chelseas, for instance, are 1¼ x.d., County 57s., and the preference 23s. St. James's rose 5s. to 14½. London Electrics remain dull, falling another shilling to 34s. The floating supply of stock is being steadily absorbed, but there remain 1,000 Westminsters on offer at 44s. 6d., 500 Countys at 56s. 6d., and the same number of City Lights at 47s. 6d. Westminsters pay the best in the London list, but St. James's still yield about 6 per cent. and Chelseas return 6¾ per cent. on the money.

The Isle of Thanet Electric Supply Company announces the usual dividend of 6 per cent. on the preference shares, but no dividend is yet forthcoming on the ordinary. The price of the latter, which is 17s., indicates the expectation of a distribution at the end of the current year. The Bromley (Kent) interim dividend is to be at the rate of 4 per cent. free of tax, the same as it was a year ago, and the price of these shares, which seldom varies, is 34s. 6d. middle. No bargain has been recorded in the shares since the early part of June, when they changed hands at 34s. The full dividend for last year was 10 per cent. free of tax.

Yorkshire Electrics at 29s. 6d. are rather better, and a good deal of business is passing in the preference as well as in the ordinary shares of the provincial power, lighting and tramway companies.

Home Railway stocks make an indifferent showing. Metropolitans have eased off to 67, and the £10 shares of the Underground Electric Railways have gone back to 2¾. There is nothing of interest to report in the London traction descriptions, but British Electric Traction shows no diminution of its strength. The ordinary stock is 1 up at 117½. The persistent buying that has taken the price to its present level is based upon what is regarded as the practical certainty of an early improvement in the dividend. Some of the prior-charge stocks of the British Railways have eased off. London Electric 4 per cent. preference, as an example, declined to 71½.

The Lisbon Electric Tramways re-enters the dividend list with a payment on account of the arrears of interest on the preference shares for the period from July, 1917, to December 31st, 1919. This is the first dividend that the shares have received since 1917. The preference stand at about 13s. 9d. and the ordinary were done a few days ago at 6s., although the official quotation for the latter is, anomalously, no better than 2s. 6d.—5s.

To the rise in Automatic Telephones there seems to be no end. The price is half-a-crown higher at 47s. 6d. On the basis of the last dividend, the yield is now but 2½ per cent. on the money. International Automatic Telephones have risen to 28s. It may be that some of the recent buyers are unacquainted with the fact that an American syndicate has the option to purchase these at 30s. Chili Telephones have risen to 5⅜ and United River Plates are 3/16 up at 7 11/16. Orientals are also a better market at 2 1/16. Brazilian Tractions, after a rise to 75, reacted a trifle, and Anglo-Argentine Tramways first preference at 3⅜ show a small reaction. The Mexican stocks, generally speaking, are hard. The best feature is a rise of 3 to 65 in Mexican Light & Power preferred. Amongst Colonials, Melbourne Electric ordinary gained 2 points at 151, and in the foreign traction group, Rio Tramways 5 per cent. second debentures at 86 are harder.

A slight decline occurred amongst a few of the shares of the manufacturing group. General Electrics, British Insulated, British Aluminiums and Brush are a little easier. On the other hand, Telegraph Constructions advanced to 26¾. British Electric Transformer preference strengthened to 19s. 6d. The engineering group is dull, though Babcocks keep steady at 2¼.

The Rubber market ferments in a state of incipient buoyancy, with buyers eagerly clamouring for shares. Those men whose business lies principally in this market have as much as they can do to cope with the orders that they receive, amongst which orders those for the purchase of shares largely predominate.

Share List of Electrical Companies

HOME ELECTRICITY COMPANIES

	Nom	Dividend 1923	Dividend 1924	Price Sept. 14. 1925	Rise or fall	Yield p.c.
Bournemouth and Poole	£1	13	14	3	—	4 13 4
Brompton Ordinary	£1	10	10	1⅞	-	*5 14 3
Charing Cross Ordinary	£1	14½	15	£0/-	—	6 2 5
do. do. 4½ Pref	£1	4½	4½	17/-	—	5 6 0
Chelsea	£1	12	12	17/xd	+9d.	6 8 0
City of London	£1	15	15	48/3	—	6 4 4
do. do. 6% Pref	£1	6	6	23/-	-	5 4 4
Clyde Valley	£1	8	8	29/-xd	—	5 10 4
County of London	£1	15	15	37/-xd	1/	5 5 3
do. do. 6% Pref.	£1	6	6	23/-xd	+6d.	5 4 4
Edmundson's Ordinary	£1	7	7	22/-	—	6 7 3
do. 7% Pref.	£1	6	7	21/6	—	6 10 3
Elec. Supply Corporation	£1	10	10	31/3	—	6 8 0
Kensington Ordinary	£5	14	15	12⅞	—	5 18 8
Lancs Light and Power	£1	7½	7½	26/6	—	5 15 5
London Electric	£1	10	10	34/-	- 1/-	5 17 8
do. do. 6% Pref	£5	6	6	£4½	—	5 7 10
Metropolitan	£1	10	11	39/-	—	5 11 4
do. 4½% Pref.	£1	4½	4½	17/-	—	5 5 11
Midland Counties	£1	5½	6	22/9	—	5 5 6
Newcastle-on-Tyne Ordinary	£1	6	7	23/3	—	6 0 5
do. 5% Pref.	£1	5	5	18/-	—	5 6 8
do. 7% Pref.	£1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	£10	6	6	£½	—	6 6 4
North Met. Elec. 6% Pref.	£1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	£5	17½	17½	14½	+ ¾	5 18 8
South London	£1	15	15	2½	—	6 0 0
South Metropolitan Pref.	£1	7	7	1½	—	5 12 0
Urban Ordinary	£1	4	4	18/3	—	4 7 8
do. 6% Pref.	£1	6	6	19/6	—	6 3 1
Westminster Ordinary	£1	15	15	44/-	—	6 16 4
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	1	—	7 10 0
Yorkshire Elec.	£1	8	8	29/6	+6d.	5 8 6

HOME RAILS.

Central London Ord. Assented	Stock	4	4	66	—	6 1 3
Metropolitan	,,	4	5	67	— ½	7 9 3
do. District	,,	3½	3½	43½	—	8 0 11
Underground Electric Ordinary	£10	Nil	Nil	2⅞	— ⅛	Nil
do. do. "A"	£1/-	Nil	Nil	7/-	—	Nil
do do. Income Bonds	£	6	6	96	—	*6 5 0

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	108½	—	5 15 11
do. Def.	,,	1½	1½	24	—	6 5 0
Automatic Telephone	£1	3	6	47/6	+ 2/6	2 10 7
Chili Telephone	£5	6	5	5⅝	+ ⅛	*4 8 11
Cuba Sub. Ord.	£10	5	5	6⅞	—	7 8 2
Eastern Extension	£10	10	10	17½	—	*5 15 11
Eastern Tel. Ord.	Stock	10	10	172½	—	*5 15 11
Globe Tel. and T. Ord.	£10	10	10	17½	—	*5 12 8
do. do. Pref.	£10	6	6	11	—	5 9 1
Great Northern Tel.	£10	22	22	32½	—	6 15 6
Indo-European	£5	7	8½	41½	—	*5 2 5
Marconi	£1	10	10	1 7/16	+ 1/16	6 19 2
Marconi Marine	£1	10	7½	18/3	+9d.	8 0 0
Oriental Telephone Ord.	£1	12	12	2 1/16	+ 1/16	*5 16 4
United R. Plate Tel.	£5	8	8	7 11/16	+ 1/16	4 14 10
Western Telegraph	£10	10	10	16½	—	*6 3 1

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref.	£5	5½	5½	3⅜	— 1/16	8 3 0
do. do. 2nd Pref.	£5	6	6	3⅜	—	8 17 10
do. do. 5% Deb.	Stock	5	5	75½	—	6 10 9
British Electric Traction Ord.	,,	6	6	117½	+1	5 2 0
do. do. 6% Pref.	,,	6	6	105	—	5 14 3
Brazil Traction	100	4	4	73½	—1	5 8 10
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	88½	—	5 11 9
do. do. Preferred	,,	96/-	96/-	89½	—	*5 7 8
do. do. Deferred	,,	129/6	129/6	109½	—	*5 18 3
do. do. Deb.	,,	4½	4½	76½xd	—	5 11 1
Lond. & Sub. Trac. 5% Pref.	£1	2½	Nil	4/6	—	Nil
London United Tram. Deb.	Stock	4	4	49½	—	9 8 4
Mexico Trams, 5% Bonds	—	5	5	61½	+1	8 2 8
Mexican Light Common	100	Nil	Nil	3⅛	—	Nil
do. Pref.	100	Nil	Nil	£5	+3	Nil
do. 1st Bonds	—	5	5	70½	+1	7 1 10
Yorkshire (West Riding)	£1	5	—	18/9	—	5 6 8

MANUFACTURING COMPANIES.

Babcock & Wilcox	£1	12	12	2⅝	—	*4 16 0
British Aluminium Ord.	£1	5	10	1⅛	— ⅛	5 18 6
British Elec. Transformer Pref.	£1	Nil	7	19/6xd	+1/3	... ...
British Insulated Ord.	£1	15	15	3½	—	4 12 4
Brush Ord.	£1	10	10	1⅜	—9d.	8 17 10
Callenders	£1	15	15	3⅜	—	4 9 0
do. 6½% Pref.	£1	6½	6½	23/9	—	5 9 5
Crompton Ord.	£1	Nil	Nil	⅜	—	... ...
Edison-Swan	£1/-	10	10	9/-	—	4 8 11
do. 5% Deb.	Stock	5	5	80½	—	6 4 3
Electric Construction	£1	10	10	30/6	—	6 11 2
Enfield Cable, Pref.	£1	7½	7½	1⅜	-	6 0 0
English Electric	£1	5	5	18/9	—6d.	5 6 8
do. do. Pref.	£1	6	6	20/6	-	5 17 1
Gen. Elec. Pref.	£1	6½	6½	23/9	—	5 9 5
do. Ord.	£1	6	7½	27/-	—9d.	5 11 1
Henley	£1	15	16	3⅛	—	4 18 6
do. 4½% Pref.	£5	4½	4½	4⅜	—	5 6 0
India-Rubber	£1	5	5	22/-	—	*4 10 11
Johnson & Phillips	£1	10	10	49/6	—	3 14 9
Met-Vickers, Ord.	£1	8	8	24/-	—	6 10 8
do. Pref.	£2	8	8	£⅜	—	6 14 9
Siemens Ord.	£1	—	7½	1½	—	5 0 0
Telegraph Construction	£2	20	20	26½	+ ½	4 8 2

* Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS &c.		Price September 15th.	Fortnight's Inc. or dec.
a Acid, Oxalic	per lb.	6¾d.	...
a Ammoniac, Sal	per ton	£60	...
a Ammonia, Muriate (large crystal)	,,	£60	...
a Bisulphide of Carbon	,,		...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4¼d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£15 15s.	...
a Sulphur, Commercial	,,	£7 15s.	...
a ,, Roll	,,	£7 15s.	...
a Soda, Chlorate	per lb.	3¾d. to 3¾d.	...
a ,, Crystals	per ton	£5 to £5 5s.	...
a Sodium, Bichromate, casks	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots	per ton	£120 to £125	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/8 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net	£229	...
Grade II	,, ,,	£164	...
Grade III	,, ,,	£95	...
c Brass (rolled metal 2" to 12" basis)	per lb.	9¼d.	...
c ,, Tubes (solid drawn)	,,	1/- to 1/0½	...
c ,, Wire, basis	,,	10¼d.	...
c Copper Tubes (solid drawn)	,,	1/1½	...
c ,, Bars (best selected)	per ton	£98	£1 inc.
c ,, Sheet	,,	£93	£1 inc.
c ,, Rod	,,	£93	£1 inc.
d ,, (Electrolytic) Bars	,,	£68 15s.	25s. inc.
d ,, Sheets	,,	£142 10s.	...
d ,, ,, Wire Rods	,,	£78 15s.	25s. inc.
d ,, H.C. Wire	per lb.	9¼d.	¼d. inc.
f Ebonite Rod	,,	2/3 to 2/4	...
f Sheet	,,	2 3 to 2/6	...
n German Silver Wire	,,	2/3	...
h Gutta-percha, fine	,,	8/9	...
h India-rubber, Para fine	,,	3/-	1d. to 2d. dec.
l Iron Pig (Cleveland Warrants)	per ton.	nom.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£31	...
g Lead, English Pig	,,	£39 15s.	5/- dec.
g Mercury	per bot.	£13 10s. to £13 12s. 6d.	...
e Mica (in original cases) small	per lb.	8d. to 8/-	...
e ,, medium	,,	4/- to 8/-	...
e ,, large	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/0½	...
p ,, ,, drawn bars & rods	,,	1/8	...
p ,, ,, rolled strip & sheet	,,	1/9½	...
p ,, ,, wire	,,	1/8½	...
o Platinum	per oz.	£36	...
d Silicium Bronze Wire	per lb.	1/0½	...
r Steel, Magnet, in bars	,,	7½d.	...
e Tin, Block (English)	per ton.	£258 5s. to £258 10s.	£7 15s. to £8 inc.
n Wire, Nos. 1 to 16	per lb.	8/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
o C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

The Properties of Some Aluminium Alloys.—In a paper presented at the annual autumn meeting of the Institute of Metals, Mr. Harry Hyman, Ph.D., said that aluminium alloys available for sand castings for engineering purposes generally possessed low ductility; this rendered them difficult to manipulate in workshop practice. If used as part of apparatus on board ship they were readily susceptible to corrosion. A series of alloys was prepared with a view to passing a minimum test of 5 tons yield point, 10 tons breaking stress, and 5 per cent. elongation on sand cast test-bars, and at the same time capable of undergoing a severe salt spray corrosion test without marked loss in weight. The alloy B.S.7, containing copper, nickel, iron and magnesium, gave the most promising results and had been adopted on a commercial scale. The mechanical tests could be readily maintained; fatigue tests showed the metal to be reliable under alternating stress, and it could be remelted several times without deterioration. Under the corrosion test its behaviour was as good as other alloys with which it was compared. When the magnesium content was increased, an alloy readily responding to heat treatment at temperatures about 50 degrees higher than those generally in use was obtained; owing to the increased mobility of the constituents at the higher temperatures the period of heating could be materially reduced.

A Large Condenser.—An exceptionally large single steam condenser has been built by the Westinghouse Electric and Manufacturing Co. for the new Richmond station of the Philadelphia Electric Co. It weighs almost 1,000,000 lb. and stands nearly 30 ft. high; when operating at maximum capacity it will require approximately 150,000,000 gallons of circulating water per day. It has a cooling surface of 70,000 square feet. Provision has been made for the ultimate installation of 12 condensers of this type.

The British Association.—IV.

The Southampton Meeting.

Electricity Supply and Electrical Plant at the Southampton Docks.

By H. WAUCHOPE.

(Abstract of Paper read before Section G.—Engineering.)

The Southampton Docks provide a good example of the rapid increase in the use of electrically-operated machinery in docks. Fifteen years ago, with the exception of grain-handling machinery and one 50-ton crane, electricity as a power agent was unknown in the Docks, although electric lighting had been in use for a number of years. The power was originally supplied by a small generating station in the docks, but at the time when the building of the Trafalgar Graving Dock

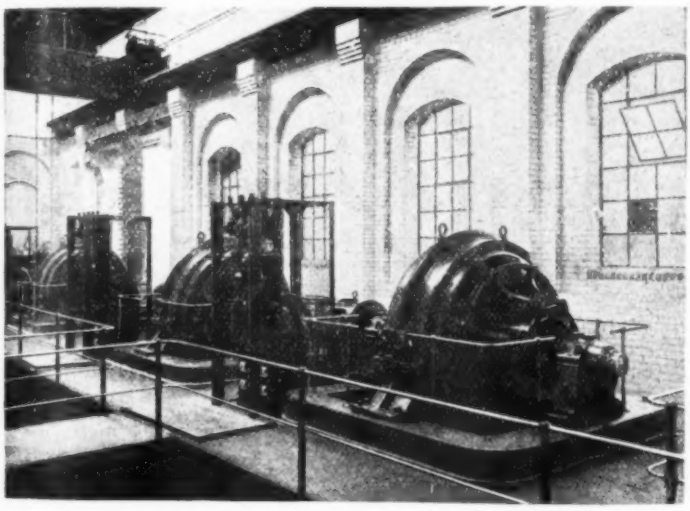

Fig. 1.—G.E.C. Rotary Converters in the Main Sub-Station.

was entered upon, this station was found to be inadequate to meet the increased demand, and a new station was built. This was completed in 1903, and housed two reciprocating steam sets of 500 kW each, either of which was capable of meeting the requirements. The present supply of electricity provides for a maximum demand of 3,500 kW. When the Ocean Dock was completed in 1911, it was decided to use electrically-operated wharf cranes, and the first batch of eight cranes, supplied by Messrs. Stothert & Pitt, Ltd., of Bath, were erected in that year. The cranes were found to be highly economical and successful in operation, and from that time further cranes have been rapidly added, some of them replacing hydraulic cranes. In 1923 an extension of electrification was decided upon. This development was given an impetus by the purchase by the Southern Railway Co. of a 60,000-ton floating dock, the operation of which requires 1,200 kW.

The first consideration was obviously to provide for a larger supply of electricity, and an agreement was entered into with the Southampton Corporation for the supply of all the necessary electricity. At that time the maximum load had already increased to approximately 1,000 kW. The total new requirements aggregated 4,000 kW, but the maximum demand was reduced by refraining, as far as possible, from pumping the three larger docks at the same time.

The No. 6 Pumping Station was retained as the main supply point, and the Corporation supply enters at this building at 6,600 V, three-phase, 50 cycles. A portion is converted to the standard Dock supply of 480 V, d.c. (three-wire). High-pressure current is also distributed from the station to Nos. 3, 4, and 5 pumping stations. At No. 5 Pumping Station the current is used to drive the dry dock pumps and a portion is converted to 480 V d.c. in order to cope with the growing need for power at this extreme end of the Docks and also to drive a hydraulic pressure pump. At No. 4 Pumping Station the current used is for dry docking purposes only, and at No. 3 Pumping Station for dry docking and hydraulic pressure pumps.

In order to economise space and unify supervision the layout of the sub-station has been arranged in three storeys. On the main pump floor 25 ft. 6 in. below the ground level is situated the dry dock pumping machinery. On the ground level, carried on a steel joist structure, is the converting machinery and the switchgear, while an intermediate gallery accommodates the transformers for supplying the rotary converters and the e.h.p. stator switchgear operating two of the main pumps. The Corporation supply is fed into two e.h.p. ironclad switches of Messrs. Reyrolle & Co.'s manufacture, which in turn supply the seven-panel e.h.p. consumers' distributing switchboard, which is of the draw-out truck type manufactured by the Mentropolitan-Vickers Electrical Co., Ltd. Three of the panels of this switchboard supply three 1,000-kW rotary converters of the six-phase type, supplied by the General Electric Co., Ltd. (fig. 1), which are of their patent self-starting and synchronising type. The transformers, manufactured by the British Electric Transformer Co., are of that company's usual air-cooled type. From the converters, l.p. direct current is led to the main d.c. distribution board which supplies the general Dock load, the floating dock, and one main de-watering pump for the dry dock. The equipment for pumping the dry dock comprises two 48-in. centrifugal de-watering pumps, each capable of discharging an average of 450 tons per minute against a head varying from 0 to 37 ft. and one 48-in. impounding pump designed to deliver 200 tons of water per minute in order to raise the level of the water in the dock above the tide level as required, to a maximum of 10 ft. These pumps, and all the dry docking pumps supplied under the electrification scheme, were manufactured by Messrs. Gwynnes Engineering Co., Ltd., who were the main contractors for this section of the work. In order to provide for slow pumping operations which are sometimes called for, advantage was taken of the fact that sufficient d.c. had to be available to operate the floating dock, and one of the two de-watering pumps was arranged to be driven by a d.c. variable-speed motor of 1,200 b.h.p. running at 210-245 r.p.m. (fig. 2). The other pumps, for economy of operation, were arranged to be driven by motors fed direct from the e.h.p. main. In order to comply with the power-factor agreement with the Corporation these machines are of the asynchronous-synchronous type, giving a power factor on full load up to 0.9 leading. The motor driving the a.c. de-watering pump is of 1,200 b.h.p. running at 231 r.p.m., and the motor driving the impounding pump is of 350 b.h.p. running at 214 r.p.m. These machines were manufactured by the English Electric Co., Ltd.

The starting and stopping of the motors is entirely automatic, by means of push-button contactor control gear, manufactured by Electric Control, Ltd., of Glasgow. In addition to the main docking pumps at No. 6 Pumping Station, there are also one 12-in. draining pump, one 4-in. sump pump, and two charging units for the purpose of extracting the air from the various pumps for priming purposes.

As previously stated, the power is supplied from No. 6 Pumping Station for the operation of the floating dock situated near by. (This dock was described in our issue of November 7th, 1924, p. 713.) The power required to operate the dock, 1,200 kW at full load, is conveyed by means of three 1-sq.-in. lead-covered, paper-insulated cables per pole. These

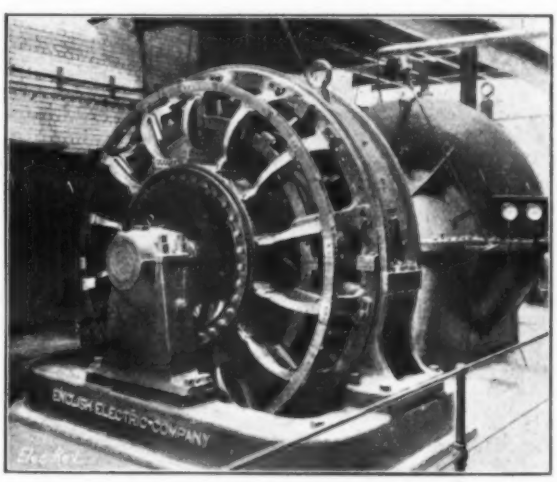

Fig. 2.—A 1,200-h.p. English Electric d.c. Motor driving a de-watering Pump.

cables are carried under one of the mooring booms and up the dock wall to the main switchboard which is erected in a cabin on the top of the starboard wall.

The No. 5 Sub-station and Pumping Station houses three groups of machinery. In the dry docking well, the floor of which is 24 ft. below ground level, are situated two 48-in. diameter de-watering pumps of similar design to those at No. 6 Pumping Station, the duty, however, being considerably less. The average amount of water displaced is about 350

tons per minute against a head varying from 0 to 36 ft. As there is not sufficient d.c. supply available at the south end of the Docks, it was necessary to install motors of the asynchronous-synchronous type. The equipment and operation is similar in all respects to that at No. 6 Pumping Station, with the exception that owing to the limited space availab'e the exciters had to be staggered and are driven from the rotor shafts by means of chain drives, the driving wheels being connected to the rotors by means of centrifugal clutches to avoid sudden shocks. Similar plant for draining, charging, &c., is installed as in the case of No. 6 Pumping Station. Situated at the side of the pumping well, six feet below the ground level, are two rotary converters and a hydraulic pump. This machinery occupies the space previously taken up by

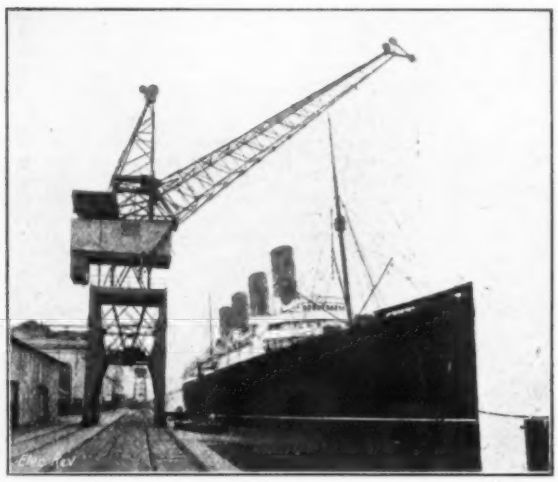

Fig. 3.—A 5-ton Horizontal Luffing Crane (Messrs. Stothert & Pitt, Ltd.).

the steam-driven ram pressure pump. The rotary converters are each of 250 kW capacity, and are similar in design to the machines at No. 6 Sub-station. The transformers are also in this case arranged under the machines.

The No. 4 Pumping Station is used solely for de-watering purposes. Two 24-in. diameter pumps are installed which can be used for emptying either No. 4 or No. 3 dry docks by the operation of electrically-driven sluice gates. The pumps are driven by three-phase induction motors, each of 175 b.h.p. running at 416 r.p.m. supplied at 415 V by means of a 300-kVA transformer, and controlled by push buttons.

The No. 3 Dry Dock and hydraulic pumping station houses two 24-in. diameter de-watering pumps used for emptying either Nos. 1, 2, or 3 dry docks. The pumping plant is similar to that at No. 4 Pumping Station, except that the pumps are of the normal single inlet type. In addition to dry dock pumping, No. 3 Pumping Station is the main centre for hydraulic power pumping for dock use. There are installed for this purpose two 17-stage turbine pumps, manufactured by Messrs. Mather & Platt, Ltd. Each pump is designed to deliver 200 gal. of sea water per minute against a pressure of 750 lb. per sq. in. The pumps are driven by three-phase slip-ring, 165-b.h.p., 415-V induction motors running at 1,450 r.p.m. For this supply, together with that for the dry dock pump motors are installed two 400-kVA transformers. The starting and stopping of the hydraulic pumps is automatically controlled by tappets on the hydraulic accumulator.

At No. 5 Pumping Station a similar pump to the two at No. 3 Pumping Station is being erected. This pump will, however, be driven by a direct-current variable speed motor. The use of direct current allows a ready adjustment of load between the pumps at Nos. 3 and 5 Pumping Stations when running together.

The majority of the berths used by the largest ocean-going liners are equipped with high-speed electrically-operated portal cranes. With the completion of the batch of cranes at present being erected, there will be an unbroken line of modern electric cranes from Berth No. 34 on the Itchen side of the Docks right round to Berth No. 47, including the whole of the Test Quays. With the exception of three cranes on No. 41 Berth which were supplied by Messrs. Babcock & Wilcox, Ltd., in 1915, and two second-hand small radius cranes on No. 45 Berth, the whole of the electric cranes, to the number of 28, have been supplied by Messrs. Stothert & Pitt, Ltd., of Bath. All those cranes are of the level luffing type using a minimum amount of power for this important motion. The first 14 cranes situated around the Ocean Dock are of solid girder construction. The actual rotating part is carried on a horizontal roller path and is centrally held by means of the usual centre post. The whole of the cranes are of the free barrel type which permits an instant and rapid lowering of the load as required, by gravity. The power consumption of this type of crane is particularly low; it is found that with the average cargo load, 4 or 5 cycles of operation can be effected with one kWh. The electrical equipment of these cranes, which in common with all the cranes in the Docks is supplied at 480 V direct current, consists of an independent motor drive for each motion.

All cranes south of No. 40 Berth are constructed throughout on the lattice principle and are of the mast type. The rotating portion of the cranes of this type is pivoted on a foot-stool bearing, suspended considerably below the gantry top and the roller path and the axis of the rollers are in the vertical plane on a level with the gantry top. No separate centre post is therefore required as the whole superstructure in a sense takes the place of the centre post.

The tendency of late has been towards increased radii. The cranes under construction at No. 34 Berth are of 86 ft. radius and the 5-ton cranes erected at No. 41 Berth which were intended for use with liners boomed off considerably from the quay have a maximum radius of 90 ft. (fig. 3). All these cranes are of Messrs. Stothert & Pitt's latent mono-rope, balanced jib type, the luffing being effected by a bell crank mechanism so arranged that over-luffing is impossible. If the luffing is carried beyond the limit, the jib merely begins to return to the minimum or maximum position as the case may be. The newer cranes are all equipped with power-operated travelling gear, whereas the older cranes previously described are moved by manually-operated gear.

In addition to the cargo cranes on the wharves, there are two electrically-operated heavy lifting cranes. The first of these is a 50-ton crane of the ordinary jib type situated at No. 6 Dry Dock. This crane, which was the first electric crane to be installed, being erected in 1904, has a radius of 87 ft. A recent addition to the plant is a 150-ton floating crane (fig. 4), built last year by Messrs. Cowans, Sheldon & Co., Ltd., of Carlisle. This crane is entirely self-contained and can either be operated by an independent generating set contained in the pontoon or by supply from the shore. It is of the luffing type and has three separate hoisting gears. The main hoist has a maximum radius of 105 ft. In this crane there are three motors of 80 b.h.p., one of 160 b.h.p., one of 60 b.h.p., and two of 30 b.h.p. The whole of the electrical control, which is mainly effected by contactors and master controllers, was supplied by the Igranic Electric Co., Ltd. The warping of the pontoon is carried out by means of four electrically-operated capstans on the deck and an electric winch is used to manipulate the anchor.

A number of warehouses situated around the Inner Dock are equipped with belt conveyors for handling grain, the grain, in the first place, being raised from the ship's hold by means of a bucket type elevator of 100 tons per hour capacity. All this machinery is electrically driven but there are no features in connection with it which can claim special interest

After tests of many types of electric battery trucks it was decided to employ the electric elevating platform truck manufactured by the Elwell Parker Electrical Co., Ltd. This truck, which is of a particularly robust construction, has a capacity of two tons. There are already 28 of these in operation. They are propelled by Edison nickel-iron accumulators, each capable of working on one charge for an eight-hour day; the working time can be further lengthened if required by a mid-day boost at a heavy charging rate. The charging of the batteries is carried out by means of a five-wire balancer supplied from the

Fig. 4.—A 130-ton Floating Crane (Messrs. Cowans, Sheldon & Co., Ltd.).

480-V mains. For moving odd wagons, ships' booms and gangways, and other heavy transportable articles for which horses were previously employed, two battery-operated tractors, also supplied by the Elwell Parker Electrical Co., Ltd., are in use. The longer distance conveyance of light cargo and the collection and disposal of refuse, is carried out by battery-driven lorries of 2½-tons capacity, two of which are of the tipping type. These lorries were manufactured by Messrs. Garrett and Sons, Ltd., and are also equipped with Edison batteries. These battery vehicles have amply justified the somewhat heavy first cost involved.

The various ship repairing workshops in the docks are all supplied with electricity from the dock mains, and power is also available for other occasional work.

Discussion.

The above paper and that on the Southampton electricity undertaking by Mr. W. G. Turner, which was abstracted in our issue of September 4th (p. 391), were discussed together.

Mr. ALDRIDGE, who was the engineer of the company which commenced the electricity supply in Southampton, spoke of the difficulties which the company encountered. Referring to Mr. Wauchope's paper he stated that he was the inventor of the first free-barrel crane

Mr. F. H. NALDER drew attention to the advantages of the efficiency meter which Mr. Turner had devised. He considered that its use would develop rapidly.

Prof. F. C. LEA asked Mr. Turner if the fuel-saving effected at the Southampton electricity works justified the heavy capital expenditure involved, and if the use of pulverised fuel had been considered. Many American power stations claimed great economies from the use of coal in this form. He asked Mr. Wauchope to say how electric cranes compared, as regarded running cost and reliability, with hydraulic cranes.

Mr. TURNER, in replying, said that the Southampton undertaking had the unenviable distinction of possessing five different systems of supply; a change-over to 3-phase a.c. was being made as rapidly as possible. He pointed out that a great deal of the capital expenditure was due to converting plant. Pulverised fuel had been considered unsuitable; the theoretical saving was not sufficient to justify the capital expenditure involved, although no doubt it would be excellent for a new plant.

Mr. WAUCHOPE, replying to Prof. Lea's question as to how electric cranes compared with the hydraulic type, said that the consumption of pressure units by hydraulic cranes was out of all proportion to the work that they did, as the compressors had to be kept running whether the cranes were working or not. The cranes could not be compared with electric cranes. The latter were certainly more reliable, especially in winter, and stoppages for repairs were very infrequent. The chief trouble was the plug boxes on the quays, which, at times, were apt to be flooded.

The PRESIDENT (Sir Archibald Denny) said that his experience had proved that electric cranes were far ahead of hydraulic cranes. Except for very short lifts his firm had entirely replaced the hydraulic by electric cranes.

Standardisation in Industry.

By C. LE MAISTRE, C.B.E.

(Abstract of Paper read before Section G.—Engineering.)

This paper dealt with the present position of standardisation generally. After referring to the need for greater economy in industry by the elimination of waste and excessive diversity of parts through the medium of standardisation the author said that during the past 25 years the B.E.S.A. had carried out a great deal of most useful work in industrial standardisation. The simplification and standardisation of steel sections had resulted in a saving of 5s. per ton to the steel industry, whilst recently a single electrical specification resulted in a saving of £10,000 in the stock which one company alone had to carry, or a continuous saving of £500 per annum. Since the war many other countries had instituted national organisations and in practically all cases they had drawn on the experience of the B.E.S.A. In the United States, in addition to a standardisation organisation, there had been instituted by the Government a Division of Simplified Practice, which carried on a campaign for the elimination of national waste, under the Department of Commerce. The procedure of that Department was based almost entirely on that of the B.E.S.A. with the exception that it was financed entirely by the Government, and the term "simplification" had been adopted as being more significant commercially than our term "standardisation."

Among the results of these efforts, which began in 1921 in the U.S.A., were the following:—The American miller cutter industry, after months of study and survey, had made a reduction of 35 per cent. in prices. A reduction of 50 per cent. had been made in the sheet metal industry in the varieties which had to be stocked by the ironmongers in the States. Again, in the china trade, the paper-bag industry, the lumber industry, and many others were to be found examples of reductions in varieties and consequently in prices through the application of the principles of simplified practice, upon which the U.S.A. Government was now spending £20,000 per annum.

After pointing the directions in which similar results could be achieved in this country through the medium of the B.E.S.A., the author pleaded for a greater measure of financial support for the work in hand and in prospect. At present the general funds were provided largely by industry and, to a very small extent, by the Government. The Association was not a profit-making concern, and all the expenses were concerned with office accommodation, staff salaries, and so on, amounting to £16,000 per annum. Manufacturers also helped in many ways other than in providing finance, and it was computed that the total value of the support given by industry was about £40,000 per annum. Support was also given by the Governments of the Oversea Dominions, including the Government of India and the Crown Agents for the Colonies. Considering, however, the large sums of money being devoted to similar work in the United States and other countries, the hope was expressed that the British Government would recognise the appropriateness of increasing its support of that much-needed national work so that it might no longer be as hampered as it was at present in its activities for the benefit of industry. Many thousands of copies of British Standard Specifications had been translated into foreign languages in an endeavour to assist British trade abroad, but this work had had to cease on account of lack of funds. In order to widen the scope of the membership, the Main Committee was, in October, putting into operation a scheme for the reorganisation of the membership. The members of technical committees of the Association were to be known as honorary members and a new class of membership was being formed to include professional engineers, individual firms, and business men connected with the great industries of the country, who were to be invited to become members at a minimum annual subscription of two guineas. The income from this new source would be used more particularly towards making the home work effective throughout the world. Some of the representatives of the trade organisations who had taken part in drawing up the scheme had already intimated their willingness to continue their present very considerable contributions and, at the same time, to recommend to their constituent members the great desirability of applying for membership of the B.E.S.A., thus enhancing the value of the trade contributions and assisting the Association to widen its scope.

Recent Progress in the Peat Problem.

By DR. R. MOLLWO PERKIN, C.B.E.

(Abstract of Paper read before Section B.—Chemistry.)

This paper described a new process for treating peat which the author claimed, enabled it to be marketed in a form which contained only 20 per cent. of moisture, if necessary. But peat produced by this process, in which 40 per cent. of the original moisture remained, was said to be specially suitable as a fuel for electrical generation purposes, and figures were given showing that the calorific value of such a fuel compared exceedingly favourably with coal. Although figures of working costs were not given it was stated that the cost of peat treated by the process in question compared well with that of coal. The process described was admittedly based on the failures of the past. The great problem in treating peat was to remove the large amount of water in it and many methods had been suggested for doing this which were classified as follows:—(1) Maceration; (2) Heating and compression; (3) Electrical; (4) Chemical; and (5) Macerating, heating under pressure, and briquetting. Although full details of the plant used in the process described were not disclosed, the author said that it consisted of a combination of maceration, under suitable conditions, extracting as much water as possible, and then passing the peat into an autoclave and heating it under regulated pressure. This caused a certain rise in temperature, and then the peat was suddenly discharged by means of a sluice valve the necessary water afterwards being filtered or pressed off and finally passed into a press. In this way briquettes containing from 18 to 20 per cent. of water only had been made. The speed of this plant was such that the briquettes were made within eight hours and were immediately ready for transport, being very hard and not liable to disintegration. It was said that the process was extremely simple to work and did not require much labour.

The author said that British peat was much superior in many respects to foreign peat and that in the United Kingdom and Ireland there was some 8,000,000 acres of an average depth of 12 to 14 feet. Dr. Perkin made a strong plea for the immediate development of this new industry, now that it had been shown that there was an economic and commercial process available. The fuel, he claimed, would not compete with coal in the ordinary way. On the other hand, from it smokeless briquettes were obtained, as well as a very valuable charcoal for metallurgical purposes—to replace the Swedish wood charcoal now imported—a high yield of oils, and a material valuable as a decolorising agent. The specific gravity of the peat so treated was about that of coal, so that the freightage would not be higher.

Among the processes mentioned which had been tried for the treatment of peat in order to make a commercial article, was the Buckle process. In this, the peat, after being macerated was mixed with a little water, in order to make it less pasty, and was forced under a pressure of about ten atmospheres through a tube system which was heated to a temperature of about 100 deg. C. A current of electricity at 200 V was passed through the tube system, it being claimed that electrical osmosis caused the decomposition of the hydro-cellulose. The inventors of this system stated that if the passage of the peat pulp between the electrodes was arrested, the electric current automatically ceased to flow because the peat ceased to conduct electricity as soon as the hydro-cellulose in it was decomposed. It was found advantageous to change the polarity of the electrodes from time to time in order to prevent accumulation of peat material on the positive electrode. Either alternating or direct current might be used but a direct current appeared to give the better results. The main object in heating the peat was to cause it to conduct electricity; it had been found that below 80 deg. C., peat was such a bad conductor that practically no electro-osmosis took place. A unit working scale plant was erected in Norfolk which was capable of dealing with 250 lb. of peat pulp per hour, and Dr. Perkin stated that this small plant worked very satisfactorily. It had not, however, been developed on a commercial scale. In the process described by Dr. Perkin, and for which he claimed many advantages, electricity did not play a part, so far as the actual process was concerned. The electrical interest in it was the claim that peat with from 30 to 40 per cent. of moisture made an ideal fuel for the production of electricity.

Egyptian Trade and Finance.

A Record of Prosperity.

A REPORT upon the economic and financial situation of Egypt has been forwarded to the Department of Overseas Trade by Mr. E. Homan Mulock, Commercial Secretary at Cairo.*

It is stated at the outset that Egypt is in a very prosperous condition, owing mainly to the enhanced value of cotton exports during 1924. The general trade figures show that exports from Egypt during 1924 exceeded imports by £E16,467,000. There was a substantial addition to the financial resources of Egypt during that period, this being represented by an increase in the country's foreign investments. To these important factors in the prosperous economic situation of Egypt is added the highly-satisfactory condition of Government finance, indicated by an estimated surplus of nearly £E6,000,000 on March 31st, 1925, and a corresponding increase in the Reserve Fund which on that date was approximately £E24,000,000. In addition to this, two special reserves have been created, one of which relates to the Ottoman Debt, while the other (£E1,537,000) is a reserve relating to the capital account of the State railways, telegraphs and telephones.

Telephone Development.

The 1925-26 Budget embodies a total credit of £E182,300 for telephones. This includes £E38,500 for automatic exchange equipment, £E32,500 for new telephone instruments, and £E21,000 each for telephone trunks and additional manual exchange equipment. On the revenue side, the telephones are expected to bring in £E105,000, this substantial increase over the 1924-25 figure being an anticipation of increased business upon the opening of the first automatic exchange (2,000 lines) and an additional manual exchange (6,000 lines). The automatic exchange was ordered from a British firm by the Ministry of Communications, but for a number of reasons the precedent was not followed up, the latest addition being the 6,000-line manual exchange. It is satisfactory to note that out of a total value of £E48,681, representing telegraph and telephone material imported during 1924 (as against £E33,336 in 1923), Great Britain supplied goods to the value of £E36,038, the next highest being Sweden (£E7,754). The figure represented a rise of almost 50 per cent. above the 1923 total.

Electrical Trade.

The report states that last year marked a general advance in municipal electrical undertakings in the provinces; seven contracts, totalling approximately £E180,000, for the supply and erection of equipment for generating stations have been placed. Mr. Mulock says that it is to be regretted that, with one exception only, United Kingdom manufacturers do not appear to have submitted tenders for provincial electricity undertakings. All the generating plant and most of the material for the distributing systems is being supplied by German manufacturers. One local agent, however, who represents various French suppliers having a large capital in depreciated French francs, was able to secure a contract at a very low price for an electrical distribution system, valued at about £E20,000, in the provinces. The Diesel engines for these installations are, with the exception of two small orders placed in Germany, being supplied by a well-known Swiss firm. An order for water turbines for one installation was also secured by a Swiss firm, the main contractors, however, being the local representatives of the Siemens-Schuckertwerke. A comparison of the tenders submitted shows that, whereas there was little appreciable difference between the Swiss and German prices for engines for electrical generating plant, French and British quotations were about 20 and 50 per cent. respectively above those of German firms. The only important order placed by the Ministry of Public Works during 1924 was one valued at £E12,000 for extensions to power plant, four 50-h.p. motor-pumping sets, and 4 km. of underground armoured cable for Montazah Palace. The order for Diesel engines went to Italy, that for generators to Germany, that for pumps to Switzerland, and the motor and control gear and cable was ordered from a Belgian firm. There has been little activity in the local business world, owing to the fact that the more important public utility companies purchase, as a rule, through their head offices in Brussels and Paris. An appendix to the report shows that Great Britain's share of the machinery trade has not been so meagre as the foregoing notes might suggest. Stationary i.c. engines to the value of £E399,718 were imported during 1924, and Great Britain's share of this amounted to £E216,639, as against £E147,399 in 1923. Again, out of the total imports of power pumps valued at £E59,495, the United Kingdom provided £E25,936, as against £E14,903.

In the small supply business, in spite of the fact that the market is inundated with lighting fittings and various appliances of German manufacture, there is a good demand for American goods in these lines. Small generators and motors supplied locally are mostly of French or Italian manufacture, but here, again, there is a steady demand for the superior American-made motors. Mr. Mulock considers that it is not too much to expect of British manufacturers that they should make greater efforts to capture a proportion of this trade. It is also of interest to note that local German dealers are purchasing American lighting switches in considerable quantities.

Compared with the year 1923, the volume of electrical business, apart from Government contracts, has risen steadily, and an increasing demand by local industrial concerns for electric motors has been remarked. Outside the cities of Cairo and Alexandria there has been little demand for electrical goods, but the extensive construction of new buildings in these towns has involved a large increase in installation work, which is often carried out by some obscure dealer possessed of little or no knowledge of the work.

Electrical Import Statistics.

The imports of electrical machinery during 1924 reached a value of £E146,564, as compared with £E144,361 in 1923. The shares of the principal importing countries were as follows:—France, £E45,605; United Kingdom, £E28,788; Switzerland, £E18,418; Germany, £E16,925; United States, £E13,502; and Italy, £E13,326. The United Kingdom, Germany, and Switzerland increased the value of their supplies, but those of most of the other supplying countries dropped very considerably. The total trade in "certain appliances" and batteries amounted to £E50,218, of which the German share was £E15,334, the British share £E13,569, and that of Italy £E10,493.

The electric lamp market shows little change, one Dutch firm supplying about 50 per cent. of the total consumption; but German penetration has become more marked of late. In respect of this market, a recent price agreement arrived at by most of the leading lamp manufacturers should tend to distribute this business among the various local dealers, but as the latter are not in every case adhering to this agreement, British lamp manufacturers represented locally are in a worse position than before. It is expected that further developments will arise in the future. The total import of lamps amounted to 1,363,103, valued at £E39,352; the United Kingdom's share amounted to only 13,416, valued at £E696.

Many proposals, such as traffic control by electricity in Cairo and Alexandria, electric transport trucks and overhead travellers for use at the main railway stations and warehouses, and improved electric lighting schemes, have been submitted by at least one British firm, but the Egyptian Government appears to maintain a somewhat lethargic attitude with regard to such proposals.

Advice to British Traders.

Mr. Mulock says that in spite of German competition in the small electrical supply business, it is quite reasonable to assume that if British manufacturers had extended their advertising and trade propaganda in general they would have obtained quite an important share of the trade. Under present conditions, however, their local representatives find themselves almost unable to obtain a market for their principal goods, whereas foreign competitors have every facility possible for securing distributors, &c. Foreign private enterprise, during the year under review, was handicapped by reason of the unsatisfactory political situation, but it is hoped that these adverse conditions, so prejudicial to the economic welfare of the country will, under the present Government, tend to disappear.

The lift business is at present mostly in the hands of a Milan company; the low rate of exchange in its favour and its working arrangements with local building contractors leave little chance for competitors to seriously disturb its position. However, as a well-known Swiss firm of lift manufacturers has cut prices with a view to challenging the Italian firm's supremacy, it is to be hoped that United Kingdom firms will also study this very difficult market.

* Stationery Office, 2s. net.

Suggested Development in Persia.—In the course of a report to the Department of Overseas Trade, Mr. R. H. Hadow, M.C., Secretary in Charge of Commercial Affairs at the British Legation, Tehran, says that there can be little doubt that an opportunity presents itself to any firm which can make a satisfactory agreement with the Persian Government for the utilisation for electrical purposes of the energy existing within measurable distance of the capital in the form of two considerable rivers, each of which could be dammed with no apparent difficulty. Provision in this manner of cheap power for lighting, traction and heating would make no small difference to the life of the capital, and would doubtless lead to similar development in other districts of Persia, such as Tabriz, Ispahan, and Shiraz. An accurate survey of the rivers would be necessary. The report also says that a concession for the development of telephonic communication in Persia has been for some years in the hands of the Persian Telephone Co., which has recently commenced work in Tehran in conjunction with the German firm of Siemens and Halske. At the present time telephone systems exist in the principal cities of Persia, but the companies are small and the service is variable.

Underground Cables in the United States.

SOME particulars of interest concerning cables installed in the United States are given by the *Electrical World* in a review of the work of the Underground System Committee of the N.E.L.A. during the past year.

During 1923 and 1924 the Electrical Testing Laboratories of New York tested 3,725,999 ft. and 4,269,139 ft. of cable respectively. Of the latter 87.45 per cent. was passed, 8.45 per cent. held over as deficient in minor respects, 3.84 per cent. rejected and 0.26 per cent. withdrawn by the manufacturers. The outstanding points of interest considered were the high-pressure joints made on cables installed in America. These joints were of the design of three European companies and were installed on cables made by these firms under the supervision of their engineers. The designs of these joints, as regarded the amount of applied insulation, dimensions, filling temperatures and pressures, methods of connecting the conductors, &c., were very different from each other and from American practice.

Eight months' service of the two 66-kV lines in Cleveland has resulted in no joint failures in service, and three failures in tests. The test failures were ascribed to the migration of a large amount of the filling compound, which is "thin," into the cable itself.

There have been several installations of submarine cables and one of the most recent, of particular interest because of the large number of cables and the magnitude of the voltage, is the installation at St. Louis, for the Union Electric Light and Power Company. The construction of the joint on the 3-core, 33-kV submarine cable is shown in fig. 4, and the details of the armouring splice and the method of clamping the armour on the cable are shown in fig. 5.

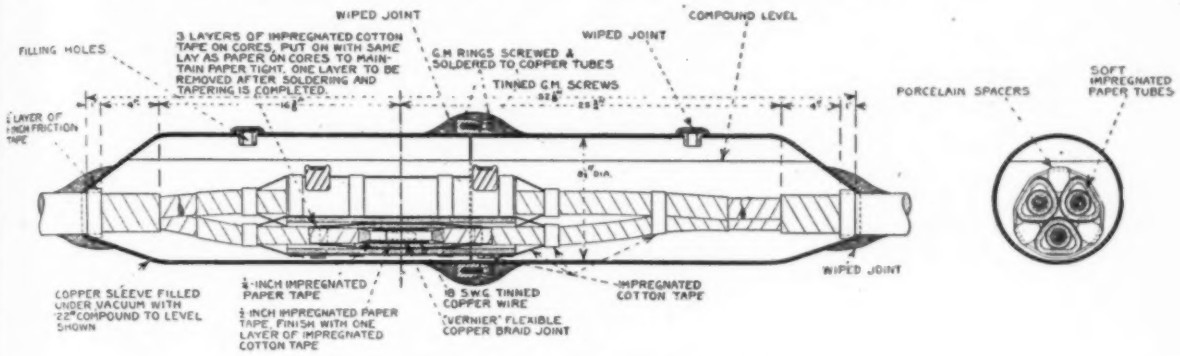
WIPED JOINT
COMPOUND LEVEL
FILLING HOLES
3 LAYERS OF IMPREGNATED COTTON TAPE ON CORES, PUT ON WITH SAME LAY AS PAPER ON CORES TO MAINTAIN PAPER TIGHT. ONE LAYER TO BE REMOVED AFTER SOLDERING AND TAPERING IS COMPLETED.
G.M. RINGS SCREWED & SOLDERED TO COPPER TUBES
WIPED JOINT
TINNED G.M. SCREWS
PORCELAIN SPACERS
SOFT IMPREGNATED PAPER TUBES
1 LAYER OF ½INCH FRICTION TAPE
WIPED JOINT
COPPER SLEEVE FILLED UNDER VACUUM WITH 22" COMPOUND TO LEVEL SHOWN
¼-INCH IMPREGNATED PAPER TAPE
½ INCH IMPREGNATED PAPER TAPE, FINISH WITH ONE LAYER OF IMPREGNATED COTTON TAPE
18 S.W.G. TINNED COPPER WIRE
'VERNIER' FLEXIBLE COPPER BRAID JOINT
IMPREGNATED COTTON TAPE

Fig. 1.—Section of 35-kV Cable Joint (B. I. & H. Cables).

The design of potheads which have been used for pressures below 15,000 V has been standardised in some cases for several years and very little trouble is experienced with them. Recent cable installations at pressures as high as 35 kV for 3-core cables and 66 kV, 3-phase, for single-core cables, have produced the necessity for potheads for these installations, and the requirements have been met successfully. At the present time there are manufacturers who claim that they can make potheads which will be satisfactory for single- conductor cables on 100- to 132-kV three-phase circuits. Thirty-one companies have contributed information on high-pressure cable performance for the year 1924. While this is twice the number of companies that reported during the previous year, the total mileage of cable of the additional companies is only about 8.4 per cent. of the total. The total amount of high-pressure cable in operation by all the companies which reported for 1924, including all pressures of 6,600 V and over, is 7,321 miles. Of this 85 per cent. is operating at pressures below 16,500 V. The total mileage of h.p. cables in operation during 1924 represents an increase of about 36 per cent. over that for 1923.

The combined cable and joint failures for 1924 was 13.3 per

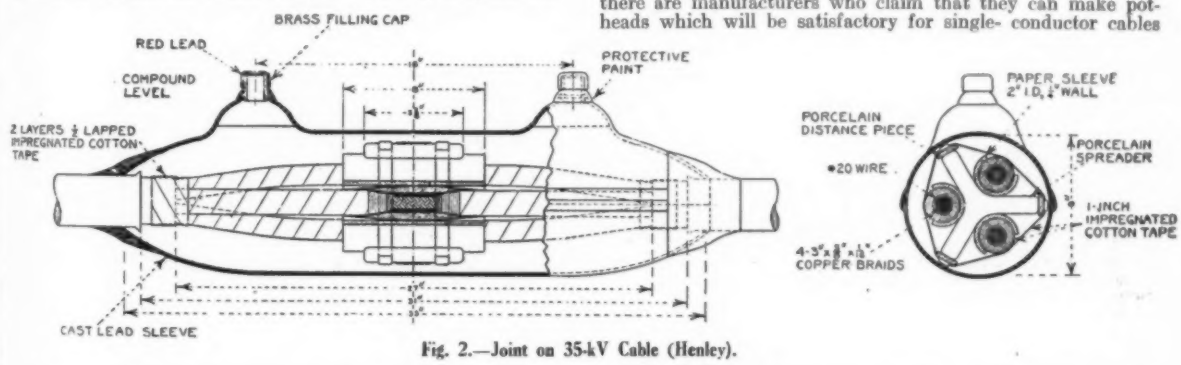

Fig. 2.—Joint on 35-kV Cable (Henley).

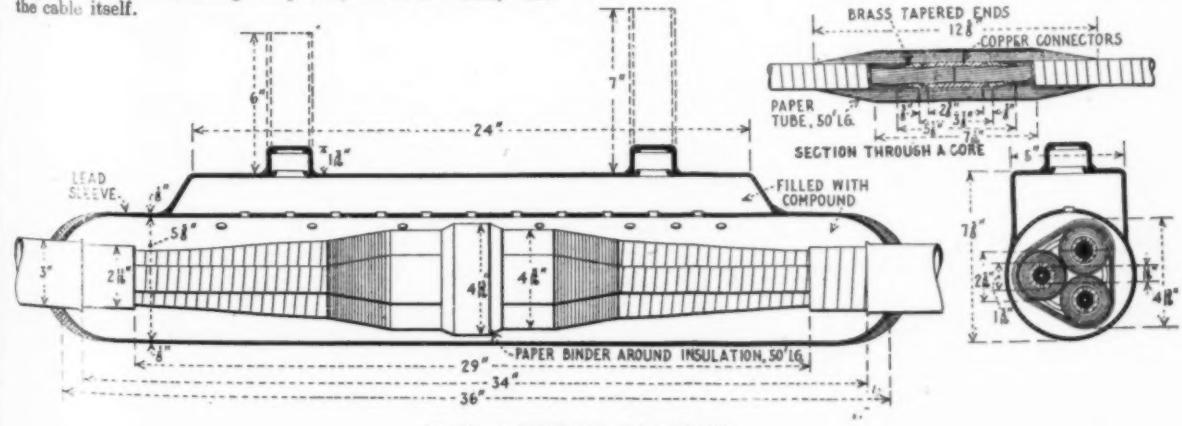

Fig. 3.—A 36-kV Cable Joint (Pirelli).

A joint for a 350,000-circ. mil, 3-core, 35-kV cable, installed by British Insulated & Helsby Cables, Ltd., in Chicago, is shown in sections in fig. 1; fig. 2 shows the sections of a joint on a similar cable by Messrs. W. T. Henley's Telegraph Works Company, Ltd.; and a 300,000-circ. mil, 3-core, 36-kV joint installed in Boston by the Società Italiana Pirelli is shown similarly in fig. 3.

cent. of the total; this is about 14 per cent. higher than for the two previous years. Elimination of the additional companies included in 1924 would not appreciably affect this record.

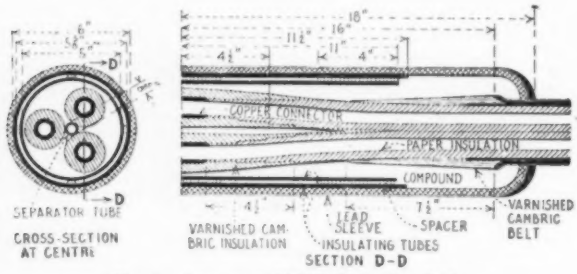

Fig. 4.—Joint on a 33-kW. Submarine Cable.

While the total cable and joint failures in the lower pressure class for 1924 are of the same order as in the previous years, this is not so in the case of the higher pressure cables, in which the total number of failures per 100 miles is not only considerably higher than for 1923, but is also about 18 per cent. above the average for the past six years. Separating cable from joint failures regardless of pressure, 74 per cent. of the failures are in cables and 26 per cent. in joints.

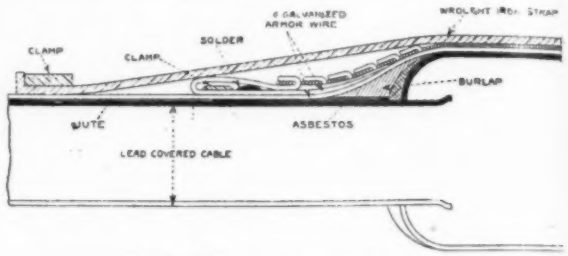

Fig. 5.—Method of Clamping Armouring

Segregation of cable for joint failures, but with respect to the two pressure classes, brings out other interesting information. Joint failures alone in the lower pressure class are only about 3.3 per 100 miles.

High-Frequency Induction Furnaces.

Their Construction and Operation.

By DONALD F. CAMPBELL.

(*Abstract of a Paper read before the* IRON AND STEEL INSTITUTE.)

THE use of high-frequency currents for induction heating has added a new series of physical conditions to those under which metallurgical operations may be performed. Although still in its early stages of development, it provides an unrivalled means for rapid experimental and research work on alloy steels, and it is being used for several metallurgical operations of the utmost importance. The early work in connection with high-frequency furnaces was carried out by Dr. Northrup at Princeton University, whose brilliant studies on the physical laws governing induction from high-frequency equipment led to the evolution of the first metal-melting furnaces.

Inductive heating has recently found wide application in the non-ferrous trade in furnaces having a vertical slot worked on normal commercial frequencies. But all these furnaces have the disadvantage of requiring an iron core, as the result of which the molten metal is contained in small channels surrounding the core, as well as in the main bath of the furnace. In the case of high-frequency heating, the ideal form of container is available, a cylindrical vessel holding a maximum metal with a minimum of radiating surface and of refractory material exposed to corrosive action. Obviously, inductive heating is superior in thermal efficiency to any arc furnace or fuel-fired equipment, owing to the fact that the heat is actually generated in the charge to be melted.

The high-frequency furnace has an immensely steep heat gradient between the molten metal and the outside of the furnace, the distance between molten platinum at, say, 1,900 deg. C., and a water-cooled copper coil being only ¾ in. in platinum-melting furnaces. This somewhat extraordinary fact does not produce excessive heat losses owing to the rate of input of calories into the charge, and the loss, being a function of time, is only considerable during the last few minutes of the melting operation, when the temperature of the metal is high.

A high-frequency furnace installation consists of a source of high-frequency current, with suitable power factor correction, and a furnace of extreme simplicity of design, but the great disadvantage lies in the difficulty and expense of obtaining the necessary equipment to produce the high-frequency currents. Spark gaps and valves are at present available for small units only; they are not the robust type of machinery desirable for metallurgical works, but they will be gradually replaced or supplemented by ordinary rotating high-frequency generators, as the demand for larger melting units increases. Such machines can now be obtained of simple and substantial construction up to 500 kW capacity, though a high degree of accuracy and workmanship are required in their manufacture, and they are expensive. The frequency required varies according to the size of the furnace and the quality of the metal.

A high-frequency furnace is shown (sectionally) in fig. 1. It consists merely of a container or crucible C placed inside a flat cylindrical coil A. The intermediate space between the coil and the crucible, which generally does not exceed 1 in., is filled with zircon or other insulating material D contained in a silica or mica sleeve B. The crucible or container may be of very thin construction, as it fulfils a different function from an ordinary crucible. If it be ¼ in. thick there is a distance of only 1¼ in. between the coil, which is generally water cooled, and the molten metal, which may be heated to over 2,000 deg. C. Thus a greater temperature gradient is obtained than in any other process of melting metals in bulk.

As the heat generated is within the metal itself, the temperature of the crucible is very much lower than that of the metal, and the heat passes from the metal to the crucible, and is not conducted through the crucible walls as in other processes. Consequently reactions between the metal and the crucible walls are reduced to a minimum, and crucibles of material quite inadmissible for melting certain metals by ordinary methods stand well in the furnace. Also, the crucible is supported outside by well-packed ground zircon, and even if a crack occurs there is seldom a loss of metal or any tendency for the crucible to break to pieces. Thus, an ordinary clay crucible, such as is used for gold assays, will make from 10 to 30 heats of nickel-iron alloys containing less than 0.02

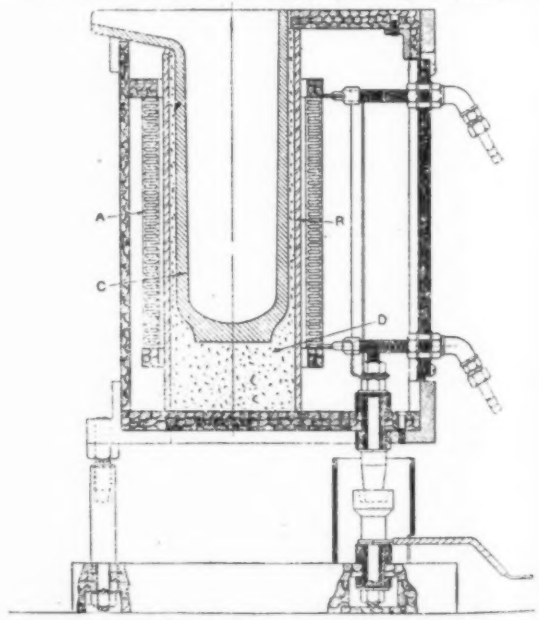

Fig. 1.—Section of High-frequency Crucible Furnace.

per cent. of carbon. This proves that the conditions under which the crucible works are fundamentally different from those of other processes. As the metal container is an ordinary crucible of cylindrical form, there is no necessity to leave metal in the furnace, or to have narrow channels or any of the other features which have rendered the old type of induction furnace uneconomical and obsolescent for the steel trade.

High-frequency furnaces mix the metal intensely, the surface of the molten metal being pronouncedly convex, owing to the violent upward current at the centre of the liquid mass. This is a great advantage for the manufacture of alloys containing metals which do not readily mix, and difficult alloys can be melted with exceptional uniformity. The frequencies used may be termed high or medium, and have varied from 20,000 to 400 periods per second, the lower figures being applicable to the larger furnaces for melting nickel-silver and similar alloys. Furnaces of a capacity of 600 lb. are now work-

ing on certain nickel alloys, and this method of melting is worth consideration by makers of tungsten and cobalt crucible steel, and anyone engaged in the manufacture of alloys of the highest

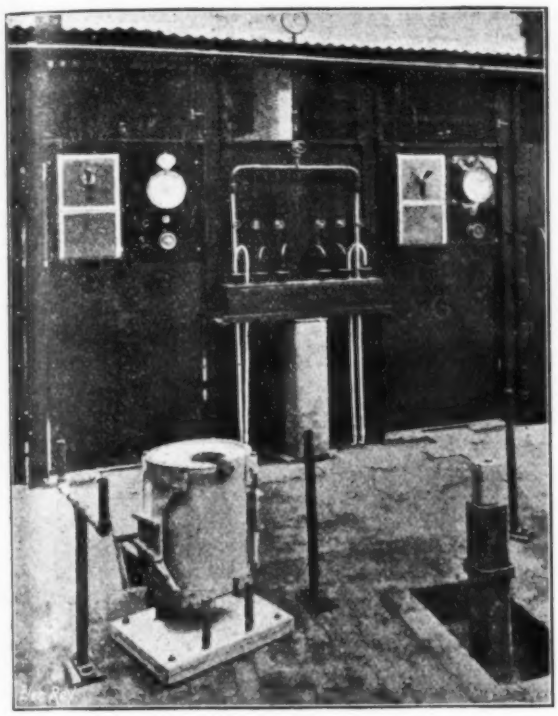

Fig. 2.—High-frequency Crucible Furnace Installation.

quality for electrical work where freedom from carbon is of the utmost importance.

The capital cost of the equipment is at present high, but this may be reduced in the future. The rate of melting is rapid, and the conditions of working are exceptionally clean, accurate, and comfortable for the workmen. The thermal efficiency is high, but the total consumption is in excess of that of good arc furnaces.

High-frequency heating may be found useful in the forging and heat treatment of steel, especially in the case of small objects of irregular shape, as the heating effect is to a great extent independent of the shape of the object submitted to the field. At present the principal application of this method of heating is in the preparation of alloys of nickel and iron with small percentages of other metals, and the lowest possible amount of carbon, which are used for the manufacture of continuously loaded cables. By the use of this metal the speed of signalling on long-distance submarine cables has been raised from a maximum of 300 letters per min. for the old type cable to 1,800 with the continuously loaded cable. This performance was obtained on a cable from the Azores to the United States and has given an entirely new aspect to the economics of submarine cabling, which, coupled with the secrecy and reliability of this form of transmission, ensures extensive demands for a larger production of this remarkable series of alloys.

An installation recently completed in England has by far the largest melting capacity of any high-frequency metallurgical works yet erected. The equipment consists of 42 small converter units, each of 35- to 40-kVA capacity, fitted with furnaces capable of melting 20 lb. of nickel-iron alloys of exceptional purity in 40 to 45 minutes. Two or more converter units may be used on single furnaces of double or treble this capacity. The melting capacity is several tons per day, and a steady and continuous output is being maintained under strictly commercial conditions. As a crucible furnace the equipment illustrated in fig. 2 has many attractive features, and is worth the attention of manufacturers who are interested in the improvement of alloy steels and other metals, especially those which may find wide application in the growing demand for improved alloys in the electrical industry.

The advantages of high-frequency furnaces for research work are very great, owing to the speed with which small heats can be made, either *in vacuo* or in air. In one instance, where an investigation was being made into the properties of a series of alloys with a relatively high melting point, 20 2-lb. heats were made in eight hours. The consequent saving of the investigator's time and the increase in the amount of work he was able to perform were of the utmost importance.

The discovery of the two principal alloys used for cable loading, permalloy and numetal, was made possible by the use of a high-frequency furnace, and further investigations are now being made in several different countries which may result in the discovery of alloys with properties previously unknown.

Electricity in Agriculture.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

(Abstract of lecture delivered at the FABIAN SUMMER SCHOOL.)

As the wealth of any nation is dependent upon the success of its agriculture, it is of great importance to see that the cultivation of crops and the rearing of livestock are put on a sound financial basis. Conditions have changed so much since before the war, that in many respects farming is a new business. The cost of labour is very much higher; taxation is very oppressive; transport in towns is now chiefly mechanical and the horse—which was a big consumer of farm products—has practically disappeared. What has to be effected is to increase the output of each farm per acre and per man. One factor that will very materially assist in this desideratum, is the application of electricity. About a year ago 200 British farmers employed it; to-day there are over 400, and it is to be anticipated that there will be over 800 within another year.

It is not generally appreciated that if the farms of Great Britain were just moderately electrically equipped, they would consume more electrical energy than the total present output of all the generating stations in the country. Here, then, lies an enormous field for the development of electricity supply undertakings.

From the financial point of view, the recent share issues of electric power supply companies have all been over-subscribed. Hence the prospects of a supply to a large section of the farming community seem promising. The load is already there, and the only problem to be solved is how to supply it economically.

One of the great difficulties is that the electrical engineer is not sufficiently acquainted with the practical requirements of the farmer; neither is the farmer enlightened as to the technical stipulations of the electrical engineer, and the implement manufacturer has not yet devoted serious study to the application of electric motors to his machines.

The first and most important use of electricity is for the lighting of the livestock byres and stables; at least half-an-hour per day per man can be saved by the aid of good light. On a dairy farm, the milk that was not accidentally spilled—owing to the existence of good lighting—more than paid for the cost of the light itself. At the present time in Great Britain there are over 50 large poultry farms which employ electric light, while about 90 per cent. of American poultry farms use it; the result is that there is an increase of winter eggs of from 15 to 34 per cent.

There are also possibilities in electric lighting for the market gardener. The author has recently obtained new results of commercial importance. The first was in connection with the transplanting of seedlings, and the second the short-time (one-night) treatment of glass-house plants, to obtain a general and more rapid progress. Ordinarily when seedlings are pricked out, they are apt to fall down and become wilted by the next day; however, when electric light was applied overnight, the seedlings were fresh and vigorous on the next morning—in fact they developed a week's normal growth overnight. With six hours' light each night, daffodils flowered in four days and narcissi in seven days. In other words, the application of electric light had accomplished three or four weeks' growth in four to seven days. The difference in the method of lighting from that which had previously been experimented with was that 1,000-watt ordinary Mazda lamps and large enamelled reflectors were employed, close to the plants, *i.e.*, very intensive illumination.

The next important use of electricity on farms, after lighting, is driving chaffing machines. Taking advantage of the convenience of electric power, many farmers now install cyclone dust extractors. The extraction of dry dust from the chaff is very beneficial to cattle.

The pumping of water is the next important application. The electrical operation of dairy and barn machinery follows as a matter of course, electric ploughing, now quite practical, is developing slowly, but surely.

Electric thrashing, with its 5 per cent. increase in output (due to the steadier running) is the next stage of application of electricity.

There are many ways in which the farmer can expedite work, such as making hay without sunshine and the curing of crops in the rick instead of by stooking on the fields.

Some years ago, in association with the late Mr. W. W.

Hood and Mr. Boyd, the writer assisted in carrying out large-scale experiments to confirm some previous laboratory tests. In 1922, both Mr. Hood and the writer for the first time, took the risk and successfully dealt with full-sized ricks. Mr. Charley Tinker made hay on a large scale in the previous year, but his work was not then known to the others. This work was carried out independently and on slightly different lines.

While the early experiments in artificial hay-making were carried out on a similar basis to that of previous experiments, subsequently changes were made, as the result of modern knowledge of ventilating engineering and scientific procedure, coupled with practical farming experience. This led to the discovery that what was required was cured hay, and not dried grass.

When the matter had been proved a commercial success, first the late Mr. W. W. Hood approached the Ministry of Agriculture and then the writer. Through the enterprise and courtesy of Sir Daniel Hall, the Ministry conducted a number of tests in 1923. Unfortunately the officials in charge did not see fit to follow the instructions of those who had developed the new system, hence the tests were not successful. However, in 1924, after very painstaking and most useful laboratory research during the winter, the technical staff of the Ministry of Agriculture, which had been transferred to the Agricultural Engineering Department of Oxford University, continued the full-scale work. This time they reverted to pre-heating of the air, which had been tried and given up as unnecessary by the earlier experimenters for ordinary hay, though it has advantages for clovers, &c. One of the two ricks thus made proved very successful, even though the method of construction of the rick was not quite correct. Anyhow, the work was sufficient to substantiate the work of what might be termed the modern school of haymaking by artificial methods.

The modern process is essentially of a very simple character and one that any intelligent labourer can carry out once he has been shown how. On the site where the rick is to be built, ducts or covered channels are constructed about ten feet apart, with openings at every ten feet of their length. The rick is built over these ducts in the usual way except that over the openings vertical shafts are constructed that reach about two-thirds up the rick, for the purpose of distributing the air equally. A portable fan is placed at the entrance of the ducts. When the rick is first built, the fan is worked for several hours, to take away the surface moisture. After this preliminary blowing, it is only necessary to blow an hour or so every day for about ten days, when the process is complete. Four years out of five, better hay will be made in this way than by the ordinary method. The whole process is dependent upon ventilating engineering principles.

Corn crops can be treated by the same process, with the further advantageous result that a better milling wheat is produced; a superior malting quality of barley is obtained; and peas can be so cured as to retain their green hue instead of being blanched.

Attention is drawn to the importance of using a special type of motor for agricultural purposes. Long experience on the Continent proved this need, for the habits of the farmers' labourers could not be changed. An agricultural electric motor must stand being left exposed to the weather, artificial manures, dust, uric acid, ammonia, &c. Further it must be simple and foolproof.

Among other problems that the engineer has to solve is the provision of cheaper rural lines; the farmers of South Wales are already setting him an example in this direction.

People talk enviously of the advantage of cheap water-power which falls to the lot of other nations, not realising that the British consumer in larger towns pays far less for his supply than his water-power-provided neighbours. The average price paid by Continental farmers is fourpence per unit for power purposes and eightpence for lighting; but at these prices, it is cheaper than any other source of power or light.

Very little is to be expected in the way of help from any Government. What is rather needed is that legislation should be so modified as to facilitate progress instead of retarding it. As regards finance, electric power supply undertakings can obtain all they require from the public.

Recently the chairman of a large electric power supply company stated that it was not practical politics to consider supplying the farmer, as it would cost at least £300 to tap the power lines. About the same time the writer heard from an Italian engineer, who was sorrowful because he could not see how to reduce the cost of his switchgear, for the same purpose, below fourteen pounds. There is a wide margin between these two figures. The latter is undoubtedly on the low side, but it indicates that a reasonable cost need not be very much more.

It must be borne in mind that in providing the farmer with electricity, the nation is benefited, for the farmer is one of the main sources of national wealth. Hence it is not entirely an unselfish matter to forward the plea for a more complete rural electrification.

Admiralty Electrical Inspectors' Salaries.—An award has just been published by the Civil Service Arbitration Court relating to the salaries of inspectors of various trades in Admiralty establishments. It is decided that the salary scale of inspectors of electricians, telephones and mains (Electrical Engineering Department), shall commence at £150 and rise by annual increments of £10 to a maximum of £220, plus the Civil Service bonus.

Proposed New Australian Tariffs.

THE *Board of Trade Journal*, dated September 10th, contained a full list of the proposed alterations in the Australian import duties. From this list the following information is abstracted. The rates are given as percentages *ad valorem*, except where specially mentioned:—

Item.	Description.	Old Rates. British preferential tariff.	Old Rates. General tariff.	New Rates. British preferential tariff.	New Rates. General tariff.
170 E.	Coal-cutting machines	free	10	free	free
176 E.	Mining machinery ...	27½	40	40	55
178 B.	Cylindrical boilers, 6 ft. and over external dia.; water-tube boilers; boiler furnaces; gas producers	27½	40	27½	40
178 C.	Steam condensers; cylindrical boilers under 6 ft. ext. dia. but not less than 4 ft. 6 in. ...	27½	40	35	55
178 D.	Motive power machinery and appliances, n.e.i. ...	27½	40	45	60
179 B.	Electrical fittings, consisting wholly or partly of metal, *viz.*, switches, fuses, and lightning arresters	27½	40	35	50
179 C.	Regulating, starting, and controlling apparatus for all electrical purposes, including distributing boards and switchboards, n.e.i.	27½	40	35	50
179 D.	Dynamo-electric machines:—				
	(*a*) up to and including 75 kW	27½	40	45	60
	(*b*) n.e.i. ...	27½	40	40	55
	Static transformers and induction coils	27½	40	35	50
	Electric fans ..	27½	40	27½	40
180 D.	Filament lamps for lighting and heating (per lb.) ...	1s.	3s.	free	2s.
180 E.	Wireless receiving sets	not specified		35	55
180 F.	Electrical and gas appliances, n.e.i. ...	27½	40	27½	40
181 A.	Valves for wireless telegraphy and telephony	not specified		free	15
181 AA.	A.c. recording watt-hour meters, each or *ad valorem*, whichever is higher	35	45	10s. or 35	15s. or 45
419 E.	X-ray transformer apparatus (except that designed exclusively for deep therapy)	free	20	27½	40
419 F, G, & H.	Various other X-ray appliances ...	free	20	free	20
380 B.	Household vacuum cleaners	30	40	free	free

"Bull" Motor Curves.—Referring to the characteristic curves of the "Bull" motor published in our issue of July 3rd, a correspondent informs us that as the b.h.p. curve has no indication as to whether it refers to the power developed at full field or otherwise, he worked out a few points from the torque and speed curves given for each case and found that the power curves at full field and with 34 per cent. diversion were exactly the same, showing the efficiencies in each case to be equal. We are informed by Messrs. E. R. & F. Turner, Ltd., that as the result of about seventy accurate tests on the machine from which the curves were taken, and a number of other tests on slightly different machines, it was found that the actual difference in efficiency between full field and diverted field conditions amounted to only about 3 per cent., the full field condition being the most efficient. As the difference was so small, only one efficiency line and one b.h.p. line were shown in the characteristic curves. These represent a mean between the diverted and full field efficiencies. It will be appreciated that there is little value in working one's calculations to fine limits when rolling resistances, due to varying road conditions, can only be predicted approximately.

New Electrical Devices, Fittings, and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

An Improved Coal Meter.

The "Lea Cubi-Meter," illustrated in fig. 1, is a recent production of the LEA RECORDER CO., LTD., 28, Deansgate, Manchester, embodying, it is claimed, the advantages of both the Lea V-notch water recorder and the Lea coal meter. It differs in principle from the Lea recorder in that the velocity of flow is an artificial one, equalling the speed of the conveyor, and is not due to gravity. The machine is driven through a worm gear driving the main axle on which the conveyor by which

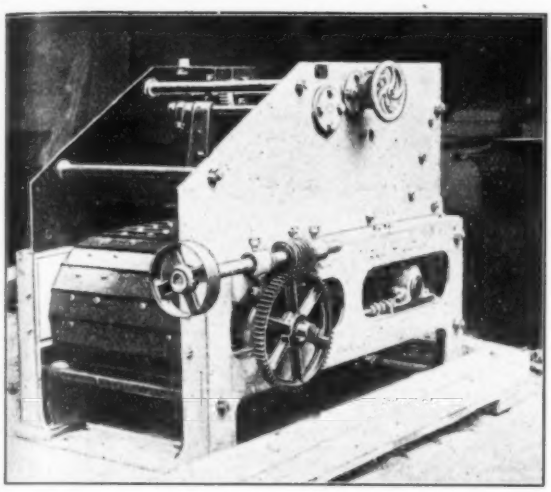

Fig. 1.—The Lea Cubi-Meter.

the coal is carried travels. The "flow" or rate of delivery of the coal is fixed by limiting the depth of the fuel as it passes through the machine. This is done by means of a regulator door which can be raised or lowered. Fig. 2 illustrates the principle of the device. The chief feature of the apparatus is the registering mechanism. A measuring door is hinged in such a way that its lower part rests on the surface of the layer of fuel passing through the machine, the angular position of the door or "flap" being determined by the thickness of the layer. A cam moves with the flap and operates a horizontal rod, varying the position of a counting pinion, attached to the rod. This pinion is geared with a toothed cylinder which

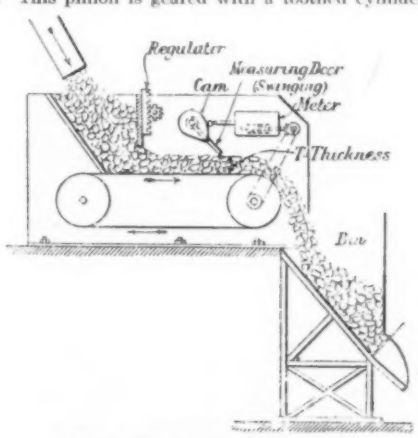

Fig. 2. Diagram of Arrangements.

is chain-driven from the conveyor shaft, with the speed of which its speed is in proportion. The teeth on the cylinder are reduced spirally towards the "low position" end so that the number of teeth which engage with the counting pinion is proportional to the distance which the pinion has travelled along the cylinder and hence to the thickness of the coal. The number of revolutions made by the pinion is thus in joint proportion to the speed and thickness at which the coal travels through the machine. The counting pinion is, of course, connected with suitable registering mechanism. It is claimed that this method of measurement of coal gives results which are comparable with any of the usual routine measurements adopted.

A New Street Lighting Reflector.

We illustrate herewith a new street lighting reflector, the "Rodalux," which MESSRS. THE BENJAMIN ELECTRIC, LTD., Tariff Road, Tottenham, N.17, have recently put on the market. It is of an unusual "inverted U trough" construction which, it is claimed, ensures a uniform illumination of the roadway for a considerable distance, and by which projected illumination is obtained up and down the road, allowing a much wider spacing between lighting points. It is made of stout-gauge steel, heavily vitreous-enamelled black outside

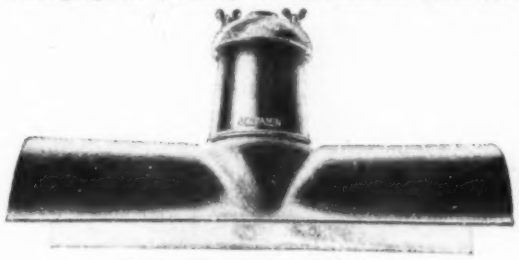

Fig. 3. The "Rodalux" Reflector.

and white inside. It is equipped with a specially designed porcelain bayonet cap or Edison screw lampholder, supported by a heavy cast-iron weatherproof flange bush. Its dimensions are 1 ft. 9 in. long by 11 in. high.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

The Manufacture of Induction Motors.

With reference to Messrs. F. and A. Parkinson's advertisement which appeared in the September 4th issue of the ELECTRICAL REVIEW, wherein they claim that they manufacture 25 per cent. of all a.c. industrial motors manufactured in the United Kingdom, we should be much obliged if they would let us know:—

1. How their estimated output of competitors' factories is arrived at, as we know of no source from which this information could be obtained.
2. What machines do they include under the heading "Industrial Motors"?
3. On what period of time is their estimate based?
4. What is the horse-power of the range of the machines covered by their claim?

As Messrs. Parkinson well know, any manufacturer could, with the greatest of ease, if he were so inclined, make an exactly similar claim to the one they have made, and we feel sure that if they can substantiate their claim they will be only too glad to do so, otherwise we presume we shall hear no further of it.

The Crypto Electrical Co., Ltd.
(J. G. SHAW, *Managing Director.*)

London, *September 14th*, 1925.

The "Davidson" Dust Collector.

In the paper on the Southampton electricity undertaking, read by Mr. W. G. Turner, A.M.I.E.E., before the British Association, and published in abstract in your current issue, reference is made to a "Cyclone" dust collector which is to be fitted to the steel chimney for the boilers shortly to be erected.

The use of the word "Cyclone" in connection with the "Davidson" patent flue-dust collector, which is the apparatus referred to, is really a misnomer, as the Davidson collector is designed upon entirely different lines and bears no resemblance whatever to the ordinary dust collector known as a "Cyclone." The "Davidson" patent flue dust collector in question consists of two distinct parts, *viz.*, first, a separator having perpendicular sides and of volute portion in plan, and secondly, a collector comprising an upper volute portion and a series of truncated cones and cylinders arranged below.

This flue-dust collector is supplied in other types to suit local conditions, space being usually the controlling factor; thus, in some cases the collector alone is applied, while in others a combination of the two forms of apparatus above described is employed.

It is, therefore, quite apparent that there is no similarity between a "Cyclone" and a "Davidson" patent flue-dust collector, which has proved its efficiency by collecting, under actual working conditions, from 30 lb. to 500 lb. of dust per hour, the quantity, of course, depending upon the quality of the fuel used.

Davidson & Co., Ltd.

Belfast, *September 9th*, 1925.

[The term "Cyclone" was used by the author of the paper.—EDS. ELEC. REV.]

Charges for Electricity Supply.

I have read with much interest the replies to my previous letter on the above subject. I am sorry to note that in view of my small consumption, I am considered a nuisance and an unprofitable consumer. I may say that my consumption of gas for the quarter was proportionately small, but the gas department did *not* double the price per B.th.u. on this account.

I note that Mr. Walker states there are several items in connection with the electrical installation, such as meter, mains, &c., which have to be paid for. Does he infer that the gas mains and meter, also the cooker, were presented to the Cor-

poration by a benevolent manufacturer for propaganda purposes?

I thank Mr. Walker for pointing out that if I took the whole of Barton's output, I might get my "juice" at ¾d. per unit, and I might be delighted to act on his advice, and install an electric cooker and radiators if I could afford them, but I fear that by the time these things were paid for, I should be unable to compare electrically and gas-cooked joints of meat, as meatless days would be the order of the day for some time to come, seeing that my means are strictly limited. In any case I prefer a coal fire.

It may interest Mr. Walker to know that I have several friends in the Eccles area who are on a straight "Pay for what you consume" basis at less per unit than Manchester and no "Minimum Charge." Remarkable for a small place like Eccles, isn't it?

May I quote an example of what is happening in Manchester? One of my neighbours was away for some considerable time during the quarter and his consumption was *four* units: the charge for this was ten shillings. Perhaps Mr. Walker will forward this gentleman some "Trylites" so that he can investigate how "juice" could possibly cost 2s. 6d. per unit, or alternatively forward me some advice how to convince this gentleman and countless others who object to paying "summat for nowt" that they are receiving fair treatment.

The "Minimum Charge" and the "Norwich Charge" are far too high for moderate-sized houses such as mine, where more than one lighting point is seldom in use. It is undoubtedly astounding to people who economise in light, to find at the quarter's end that they have just as much to pay as the people across the way who go to bed and inadvertently leave the hall light on all night.

Stung.

Manchester, *September 10th*, 1925.

Choosing and Using an Electric Washer.

I have found your article on "Choosing and Using an Electric Washer" very interesting reading, as I consider electric washers to be one of the important pieces of equipment for a farm house. In fact, as Mr. C. T. Allan stated recently at the first British Electro-Farming Conference at Chester, it is a favourite method of the South Wales Power Company when attempting to secure a farm load, to get hold of the farmer's wife through a washing machine—and the rest follows.

There seems to be a great deal of sales psychology mixed up with the selling of washing machines. There is no getting away from the fact that undoubtedly these are extremely useful, saving much labour and money. However, their use is not learnt without a little enthusiasm. It is a remarkable fact that second-hand washing machines usually fetch as many shillings as they cost in pounds, owing to the lack of salesmanship. Undoubtedly the manufacturers sell just as easily at £40 or so, as at half this figure; so I suppose they fall into the temptation.

On the Continent it is now a rare thing to find a farm house without an electrically-driven washer, and many of these only cost about £10. They are certainly not quite as refined as American machines, but they do their work efficiently. It seems to me that both washing machines and electric cookers still have to be handled efficiently. I think if your correspondent "Wren" were to write his experiences in choosing and using an electric cooker he need only delete "washer" and substitute "cooker," and what he has said would almost do.

If he does investigate electric cookers, he might also look into gas cookers, and see how many different makers would supply him with a modern type known as the "New World" cooker, wherein lies an object lesson for the makers of electric cookers.

R. Borlase Matthews.

East Grinstead, *September 7th*, 1925.

Super-Pressure Electric Cables.

In a book recently published by Mr. Del Mar on "Electric Cables," the subject of "Intersheath" cables is dismissed in four lines, chiefly on the basis of the statements by Clark and Shanklin in their 1919 paper. It may interest your readers to know that I traversed, in the paper which I read in January, 1925, before the J.I.E., the four statements (a, b, c, d) by Clark and Shanklin, and have given a complete answer to each one.

The most serious charge that they made is "high dielectric loss." Surely it is now time that technical engineers, generally, should accept the elaborate tests, extending (off and on) over a year, made on a working size of cable and under working conditions, by one of the foremost cable companies in the world, rather than a conjecture which was probably not based on any tests at all, but merely thrown out by parties (however eminent) who were conducting tests in a rather different direction.

I am not blaming Mr. Del Mar; he could not have seen my paper at the date of writing his book; but I want to call attention to the misrepresentation of facts conveyed—no doubt quite unintentionally—by Messrs. Clark and Shanklin's statements, who, I am sure, would be the first to correct them, on presentation of the facts.

Particulars of my tests were published in *The Electrician* of June 5th, 1925.

A. M. Taylor,
Major, S.O.2.

Erdington, *September 3rd*, 1925.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

6,265. "Electrical heating elements." E. L. Wiegand. August 31st, 1923. (221,180.)

12,000. "Systems of electric ship propulsion." British Thomson-Houston Co., Ltd. May 28th, 1923. (Addition to 147,029.) (216,854.)

12,030. "Apparatus for obtaining substantially steady heating effects from alternating current." W. J. Brown, E. Y. Robinson, B. A. G. Churcher, and Metropolitan-Vickers Electrical Co., Ltd. May 15th, 1924. (238,594.)

12,342. "Coloured electric incandescent lamps for advertising signs and the like." A. H. Brackensey and Franco-British Electrical Co., Ltd. May 20th, 1924. (238,603.)

12,359. "Current limiters for alternating or direct currents." E. Garavini. May 20th, 1924. (238,604.)

12,460. "Crystal rectifiers for wireless reception." A. Compare. May 21st, 1924. (238,610.)

12,490. "Electric ignition systems for twin-cylinder internal-combustion engines." British Thomson-Houston Co., Ltd., and L. Griffiths. May 21st, 1924. (238,611.)

12,572. "Construction of aerial for wireless telegraphy." R. D. Phillips. May 22nd, 1924. (238,617.)

12,732. "Synchronising systems." H. V. Higgitt and Eastern Telegraph Co., Ltd. May 23rd, 1924. (238,622.)

12,820. "Electric relays for disconnecting polyphase apparatus." British Thomson-Houston Co., Ltd. (Compagnie Française pour l'Exploitation des Procédés Thomson-Houston). May 24th, 1924. (Addition to 202,744.) (238,627.)

13,100. "Receivers for high-frequency signals." A. E. L. Scanes and Metropolitan-Vickers Electrical Co., Ltd. May 28th, 1924. 238,632.)

13,373. "Retention of insulation within sparking-plug casings and other devices." British Thomson-Houston Co., Ltd., and H. W. H. Warren. May 31st, 1924. (238,637.)

13,416. "Means for maintaining harmony between the speeds of electric motors." F. B. Holt. May 31st, 1924. (238,638.)

13,497. "Electric time fuses for blasting." W. Eschbach. June 2nd, 1924. (Addition to 210,518.) (238,640.)

13,533. "Clamping device for electric transformer windings." A. H. Railing, W. Widdowson, and A. E. Angold. June 4th, 1924. (238,641.)

13,800. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and W. Saville (Automatic Electric Co. (in part)). June 5th, 1924. (238,644.)

14,037. "Rheostats and operating means therefor." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). June 10th, 1924. (238,647.)

14,095. "Electric water heater." T. H. McQuinn. June 10th, 1924. (238,648.)

14,660. "Wander plugs for use with high-tension batteries and the like." A. H. Hunt. June 21st, 1924. (238,655.)

15,114. "Variable-speed dynamo-electric machines." British Lighting and Ignition Co., Ltd., and J. C. Hutton. June 23rd, 1924. (238,660.)

16,620. "Tuning-coil holders for use in connection with wireless telegraphy and the like." Fuller's United Electric Works, Ltd., and A. P. Welch. July 10th, 1924. (238,669.)

16,703. "Terminal for electric and wireless connections." L. J. Simon. July 11th, 1924. (Cognate applications, 23,470/24 and 25,237/24.) (238,670.)

16,999. "Deviating cams for interrupting electric circuits." British Lighting and Ignition Co., Ltd., and J. C. Hutton. July 15th, 1924. (238,672.)

17,785. "Dynamo-electric machines." T. L. R. Cooper. July 25th, 1924. (238,680.)

17,873. "Arresters for lightning and other heavy electrical discharges." W. C. Butler and R. W. Angel. July 26th, 1924. (238,682.)

21,856. "Electrically-driven apparatus for operating railway signals, train stops, and the like." Siemens Bros. & Co., Ltd., and L. De M. G. Ferreira. September 16th, 1924. (238,716.)

22,861. "Electric lamps for motor vehicles." J. Lucas, Ltd., O. Lucas, and W. H. Egginton. September 27th, 1924. (238,726.)

24,409. "Overhead trolley pulleys for trams and like vehicles." C. Kershaw and R. Russell. October 14th, 1924. (238,733.)

24,421. "Electrically-controlled direction indicator for motor-cars or automobiles and other vehicles." G. P. Denoef and M. J. A. Boisson. October 15th, 1923. (223,570.)

24,508. "Dry batteries." L. A. Levy. October 15th, 1924. (238,735.)

26,541. "Systems of heating feed-water and the like." International General Electric Co., Inc. November 6th, 1923. (224,545.)

29,414. "Crystal detector for wireless reception." W. D. McGowan. December 8th, 1924. (238,757.)

30,610. "Furnaces, and method of operating the same." British Thomson-Houston Co., Ltd. December 20th, 1923. (226,559.)

1925.

1,793. "Manufacture of vessels adapted to be electrically heated." J. Wangler Ges. January 20th, 1925. (Addition to 213,897.) (238,774.)

1,817. "Carriers for electric storage batteries or accumulators." R. F. Winder and A. Harrison. January 21st, 1925. (238,775.)

5,669. "Filament rheostats and the like." Igranic Electric Co., Ltd., and A. H. Curtis. March 2nd, 1925. (Addition to 215,096.) (238,793.)

6,123. "Dynamo-electric machinery." J. H. Holmes and A. T. Robertson. March 6th, 1925. (238,799.)

7,482. "Metal filaments for electric incandescent lamps." General Electric Co., Ltd. September 25th, 1924. (238,810.)

7,580. "Electrical tee connectors." A. B. Dibner. March 31st, 1924. (231,478.)

10,490. "Electrical anchor winch or capstan." Atlas-Werke Akt.-Ges. June 28th, 1924. (236,167.)

11,493. "Device for indicating the correct adjustment of speed of electro-motors." C. Lott. March 21st, 1923. (Divided application on 213,275.) (233,360.)

11,588. "Electric truncheon torch." A. McMurray. November 5th, 1924. (238,824.)

18,785. "Apparatus for obtaining substantially steady heating effects from alternating current for heating the cathodes of thermionic valves or for other purposes." W. J. Brown, E. Y. Robinson, B. A. G. Churcher, and Metropolitan-Vickers Electrical Co., Ltd. May 15th, 1924. (Divided application on 12,030/24.) (238,691.)